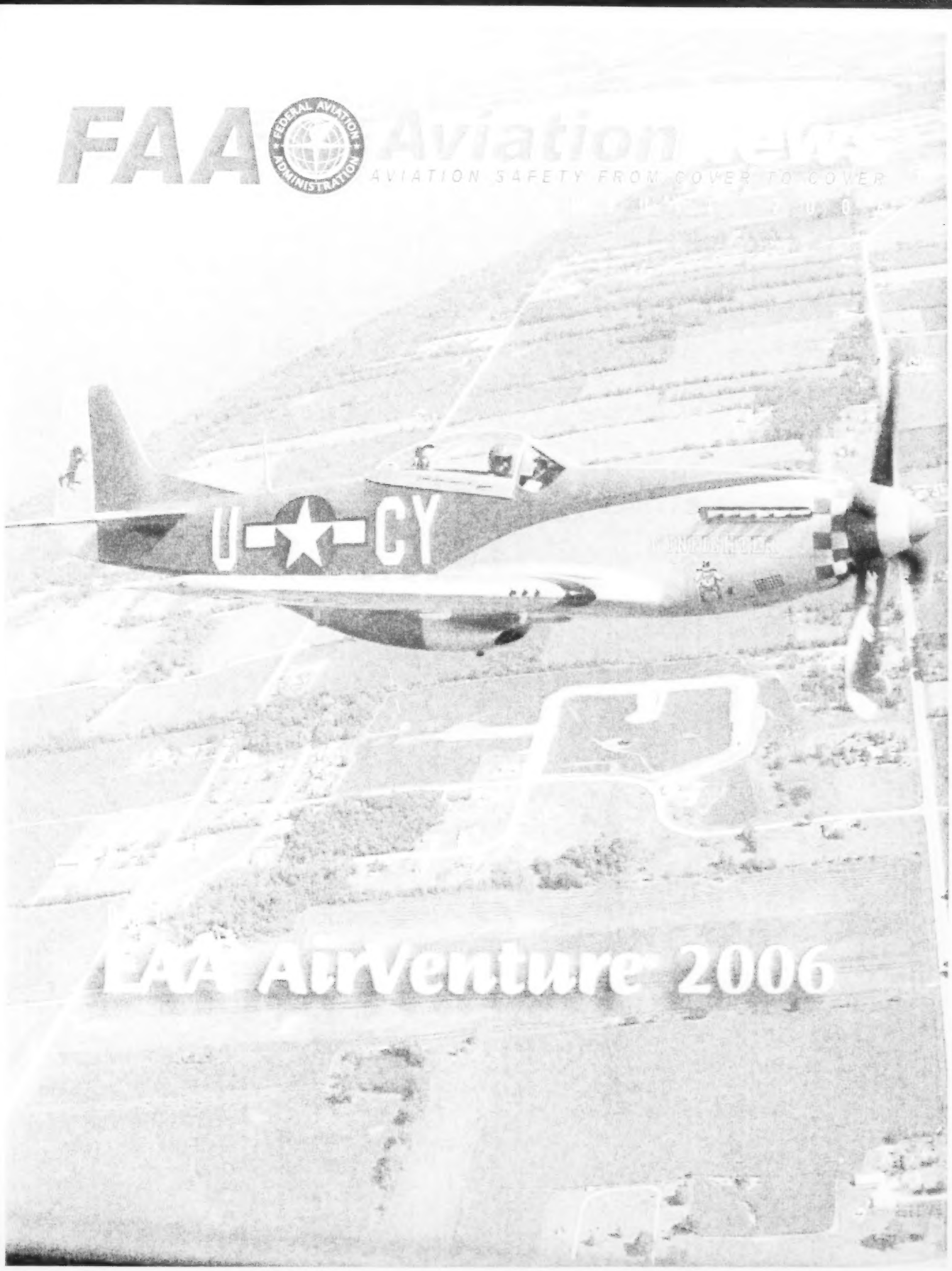
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# FAA AviationNews

AVIATION SAFETY FROM COVER TO COVER

VOLUME 45 · NUMBER 4

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*FRONT COVER: "Gunfighter," a "D" Model P-51 poses for the camera near Oshkosh. Photo by Anne X. Graham.*

*BACK COVER: Ray Stinchcomb, Jr. photographed this Dornier DO-24 ATT at Oshkosh.*

# AirVenture® 2006

story and photo by H. Dean Chamberlain

If you are going, have you done your homework for the Experimental Aircraft Association's (EAA) 2006 AirVenture Oshkosh™ fly-in? Do you know the new VFR holding patterns? What about the displaced threshold on Runway 27? What about the air show waiver times? If your aircraft doesn't have a radio, do you know about the time block for No Radio (NORDO) arrivals? These are four of the listed changes on the Table of Contents for the FAA's *Notice to Airmen* (NOTAM) for this year's AirVenture® fly-in and air show. If you are planning on flying to AirVenture® this year, you must review the NOTAM. Probably the only thing the NOTAM can't provide you with is a guaranteed tie-down spot. But, it can help tell you if the field has any spots available. However, the NOTAM will tell you how to find the Wittman Regional Airport (OSH), the neighboring airports where many pilots land rather than going into Wittman Regional, what type of windshield sign you need to make for landing at Wittman Regional including its size and coding, plus all of the other information you will need to fly into one of the busiest airport areas in the world during the last week of July.

The dates for the 2006 AirVenture Oshkosh™ are July 24-30. For those not familiar with AirVenture®, it is the world's largest fly-in. It is held each year in Oshkosh, Wisconsin. As the largest fly-in, it poses its own challenges for first time visitors. The number of visitors and aircraft can be overwhelming if you have not been there. Normally, 600 to 800 thousand visitors are there at some time during the event. Because of the number of attendees, motel and hotel rooms are normally reserved months in advance within about a 100 mile radius of Oshkosh. If you think the number of visitors is impressive, the number of aircraft of every make and model and kind that will be there that week will overwhelm you. To use a current expression, think of it as general aviation's version of "Shock and Awe."

The effective dates and times for the NOTAM are July 22 from 6 a.m. Central Daylight Time (CDT) until July 31 at 6 a.m. CDT. Please note the NOTAM is in effect before and after the public fly-in. For a free copy of the NOTAM booklet you can call EAA at 1-800-564-6322. The NOTAM is also available on the Internet at <www.faa.gov/NTAP>; <www.airventure.org>; or <www.eaa.org>.

Although this article will highlight some of the safety issues pilots and visitors should be aware of, the only official aviation guidance for the fly-in is the FAA NOTAM for the event. Please note the disclaimer in the

NOTAM that states "This Notice does not supercede restrictions pertaining to the use of airspace contained in FDC NOTAMs. Please check current NOTAMs by calling Flight Service at 1-800-WX-BRIEF." In today's world of pop-up temporary flight restrictions, all pilots must check for any type of flight restriction along the route of flight. For those pilots planning on flying to Oshkosh from the mid-Atlantic area, the Washington DC Air Defense Identification Zone (ADIZ) and Prohibited Area 40 (P-40) must be considered when flight planning. Other areas may have their own unique restrictions. You need to check for your specific flight plan.

For AirVenture® visitors in general, the EAA Internet Web sites are great. There is one main site for EAA. There is also a site dedicated to AirVenture®. Both are linked. For EAA information, you can start with <www.eaa.org>. For AirVenture®, you can go to <www.airventure.org>. The AirVenture® Web site also has a special section highlighting the flight procedures outlined in the NOTAM for flying into Wittman Regional at Oshkosh. The section's viewpoint is that of a controller telling you what you can expect. As the site says though, the NOTAM is the final word on procedures.

If you plan on landing at Wittman Regional in Oshkosh, you should also plan on an alternate airport in case Wittman is closed because of an accident, the air show is in process, or there is no place to park. Alternate fields include Appleton (ATW), Fond du Lac (FLD), or Green Bay (GRB). If you file your flight plan to Oshkosh and divert, you need to remember to modify your flight plan accordingly with Flight Service. If you plan on landing at Fond du Lac, there will be a temporary control tower in effect during this NOTAM period.

Wittman Regional will be closed to arriving traffic from 8 p.m until 7:00 a.m. CDT daily starting Saturday, July 22.

Wittman will be closed during the air show from Monday, July 24 through Saturday, July 29 from 2:30 p.m. until 6:30 p.m. CDT. Sunday, July 30, the field will be closed from 2:00 p.m. until 5:00 p.m. The air show demonstration area is from the surface to 12,000 feet MSL within a five nautical mile radius of the field.

For aircraft parking information, pilots can telephone for recorded information at (920)-230-7820. The Internet site is <www.airventure.org/aircraftparking>. The information will also be on the OSH Arrival ATIS at 125.9 MHz.

The NOTAM provides route planning guides that pilots can use to avoid high-density airports in and around Oshkosh and surrounding Wisconsin cities.

An important part of the NOTAM explains the arrival and departure procedures for the greater Oshkosh area. Included in the NOTAM are photographs of key landmarks to be used when flying the recommended arrival procedures.

Because of the possibility that VFR holding may be necessary, all pilots need to review the holding procedures for the various arrival procedures. Inbound VFR flight plans should include an extra 30 minutes for unexpected delays. VFR pilots are asked to cancel their flight plans while approaching their destination airport. As the NOTAM states, parking delays can exceed 45 minutes.

As critical as the air procedures are, there are special procedures for operating on the airport. This includes taxiing procedures, displaced thresholds, special colored dots, and parking information.

If you plan on filing an instrument flight (IFR) plan in or out of the Oshkosh area, you need to review the special IFR reservation program in effect during the NOTAM.

The above items are only a few of the special procedures outlined in the NOTAM. All pilots are advised to be especially alert for the large number of aircraft converging on the Oshkosh area during this period. Because of the mix of the many different types and categories of aircraft involved and their differing speeds, everyone must be alert for the unexpected.

Although each airport listed in the NOTAM has its own published arrival and departure procedure, a few of the common safety points include keeping your aircraft landing lights on within 30 miles of Oshkosh; bringing your own tie-down devices; carrying extra fuel if able; notifying air traffic control immediately if fuel becomes a safety of flight issue; reviewing the procedures for opening and closing your flight plan; being aware of the AirVenture® seaplane base's location and procedures and the warbird procedures; reviewing the safe operating airspeeds for your aircraft because you may have to fly at your minimum safe slow flight speed; planning on following safe fire and personal safety procedures when near parked aircraft; knowing no campfires or stoves are permitted near parked aircraft; being aware that no student flight training is permitted at Oshkosh; knowing only authorized persons are allowed on runways, taxiways, and terminal ramp; complying with the published special communications procedures in effect during this period; and if you plan on flying over Lake Michigan, you may want to use the Lake Reporting Service outlined in the *Aeronautical Information Manual* in paragraph 4-1-20(e). These are only a few of the highlights from the NOTAM.

However you get to AirVenture® 2006, remember to check out the FAA's Safety Center's Forum safety programs. Please see the Forum Schedule on page 3. For the latest information on the FAA/Industry Training Standards (FITS), you can attend a series of briefings presented by the FAA National FITS Program Manager, Tom Glista, insurance representatives, Cirrus Design, Cessna Aircraft, the University of North Dakota, Embry-Riddle Aeronautical University, the National Association of Flight Instructors, and watch a FITS video provided by Jeppesen. These briefings will be on Thursday, July 27 from 11:00 a.m. until 3:00 p.m. in the Nature Center's Tent Two.

Common sense, knowledge of the special procedures outlined in the NOTAM, and being able to safely fly your aircraft while near a lot of other aircraft will get you in and out of the Oshkosh area. Have fun. ✢

2006 AIRVENTURE OSHKOSH EAA

# FAA AVIATION SAFETY CENTER

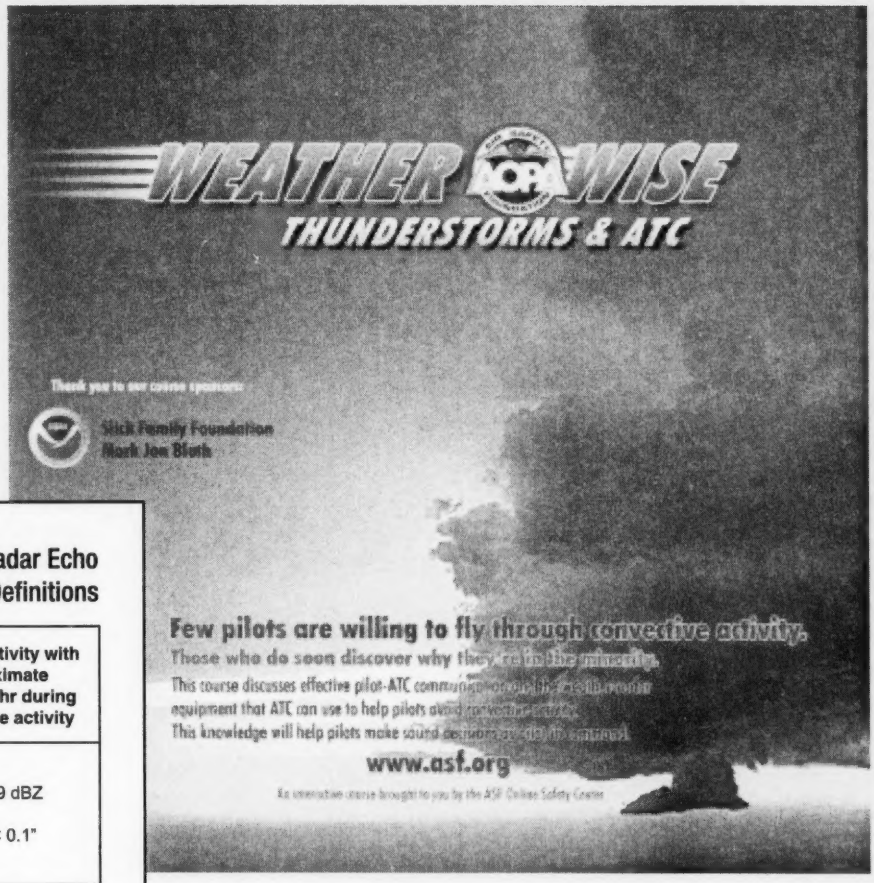
## EAA® AirVenture® OSHKOSH 2006

## Forum Schedule

| TIME | July 24 | July 25 | July 26 | July 27 | July 28 | July 29 | July 30 |
|---|---|---|---|---|---|---|---|
| 8:30 — 9:45 | FAASafety.gov<br>An Integral Part of the Pilot Flight Bag and AMT Toolbox<br>***Jim Pyles*** | Human Factors for Pilots and Maintenance Technicians<br>***Richard Komarniski*** | Human Factors for Pilots and Maintenance Technicians<br>***Richard Komarniski*** | Human Factors & Spatial Disorientation<br>***Rogers Shaw*** | Airport Situation Awareness<br>***Larry Cunningham*** | VFR Charting<br>***John Moore*** | Prescription for an Accident<br>***Bruce Edsten*** |
| 10:00 — 11:15 | Flight Instructor Professionalism in the 21st Century<br>***JoAnn & Sandy Hill, Rusty Sachs*** | Surviving Inadvertent IMC<br>***Eric Basile*** | Why Engines REALLY Quit: The Top 10 Reasons<br>***Bruce Edsten*** | Yoke & Pedal - The Art of Flying Your Airplane<br>***Rod Machado*** | Flying High Performance Airplanes<br>***Rod Machado*** | IFR Charting<br>***John Moore*** | Night Operations<br>***Kris Palcho*** |
| 11:30 — 12:45 | Sport Pilot Update<br>***Larry Clymer*** | Ditching & Water Survival<br>***Robert Shafer*** | "Meet the Administrator" | Is Your Defensive Flying Offensive<br>***Greg Feith*** | Emergency Procedures<br>***Pat Shaub*** | Lessons Learned<br>***Greg Feith*** | The Attitudes of an Accident<br>***Steve Hoogerhyde*** |
| 1:00 — 2:15 | Light Sport Aircraft Certification and Maintenance<br>***Van Stumpner*** | CFIT/Crew Resource Management<br>***Rogers Shaw*** | Transportation of Dangerous Goods/HAZMAT in Air Commerce<br>***Aaron Sinder*** | Do the Right Thing: Decision making for Pilots<br>***Pat Shaub*** | Kings on Risk Management<br>***John & Martha King*** | The Last Five Miles<br>***Pat Shaub*** | Mountain Flying<br>***Lew Owens*** |
| 2:30 — 3:45 | "Girls in the Pink Shirts"<br>***Elaine Beckner/ Amy Sedin***<br>NOTE: Ends at 4:00 | Flying in Alaska<br>***Kieran O'Farrell*** | Single Pilot IFR<br>***Pat Shaub*** | The Wither & Whether of Weather Decision Making<br>***Susan Parson*** | Secrets of the Black Box<br>***Greg Feith*** | Radios and Communications<br>***Tina Hartlaub*** | |
| 4:00 — 4:45 | | An Interview with "Aaron Tippin" Country Music Artist, Pilot, AMT<br>***Elizabeth Cory*** | | | FAA Improvement to GPS Approaches<br>***Marty Heller*** | | |

# Weather To Go

by Christine Soucy


WEATHER WISE
THUNDERSTORMS & ATC
Thank you to our course sponsors:
Few pilots are willing to fly through convective activity.
Those who do soon discover why they're in the minority.
www.asf.org

As pilot in command, you take the responsibility for the safe operation of your aircraft seriously. You have your passengers' trust that you will get them safely from point A to point B. The general aviation single-piloted IFR cockpit can be one of the busiest places on the planet when the weather is rough and you're on the gauges. Good operating practices—such as thorough pre-flight planning, maintaining your IFR currency, and designing realistic personal minimums—all contribute to safety of flight. Additionally, understanding and knowing what services and information the ATC system has to offer can sometimes make the difference between a miserable flight experience and a pleasurable one.

This time of year, our attention turns to thunderstorms. From May 2003 through May 2006, there were 11 accidents involving general aviation aircraft whose pilots inadvertently flew into severe convective weather conditions. Ten of the encounters were fatal and the eleventh suffered substantial damage to the aircraft. In the spring of 2006, the Federal Aviation Administration's (FAA) air traffic organization revised the terminology and phraseology its air traffic controllers use to describe areas of weather radar echoes in the National Airspace System (NAS). The four terms—"light," "moderate," "heavy," and "extreme"—each represent a precipitation intensity level paired with a dBZ range (Figure 1) to help pilots interpret the severity of the flight conditions present.

ATC's precipitation information can also complement the information that you may already have from your own on board weather displays or radar. While the ATC view can sometimes provide a bigger picture of what is out there, keep in mind that the air

**ATC Weather Radar Echo Terms & Definitions**

| ATC Weather Radar Terms | dBZ reflectivity with approximate rainfall in/hr during convective activity |
|---|---|
| LIGHT (see Note) | 18 — 29 dBZ<br>Trace < 0.1" |
| MODERATE | 30 — 40 dBZ<br>0.1" — 0.5" |
| HEAVY | >40 — 50 dBZ<br>0.5" — 2.5" |
| EXTREME | > 50 dBZ<br>2.5" — greater |

NOTE: Air Route Traffic Control Centers (ARTCC) controllers will not use the term "LIGHT" because their systems do not display "Light" precipitation intensities.

**FIGURE 1**

traffic controller's first duty priority is to separate aircraft and issue safety alerts regarding terrain, obstructions, and other aircraft. Additional services, such as suggested headings or radar vectors to assist pilots to avoid areas of precipitation, will be provided to the extent possible, but the service is contingent upon higher priority duties and other factors including limitations of radar, volume of traffic, frequency congestion, and workload. Subject to these factors/limitations, controllers will issue pertinent information on precipitation areas that are displayed to them on their radar scopes.

If you have done your homework, you will already have a good idea of what type of weather system you will encounter during your flight. Are conditions ripe for convective activity? If they are, will the storms be organized in lines of frontal activity or disorganized and widely scattered with storms popping up randomly like popcorn here and there? Your pre-planning is important because the air traffic radar cannot detect the presence or absence of clouds. In fact, ATC radars don't show weather areas. They only show precipitation, which could be in the form of rain, snow, VIRGA, hail, etc. In other words, a controller can tell you where precipitation is, but cannot tell you what *kind* it is. Some ATC radars can determine the intensity of the precipitation area and some cannot. Those that can will use the terms, "Light," "Moderate," "Heavy," and "Extreme." When the intensity cannot be determined, the controller will state "Intensity Unknown."

The precipitation areas that the controllers see on their radar scopes can be as old as six minutes before

**Safety Tips for IFR Flight near Known or Forecast Convective Activity**

*Flight in IMC near Known/Forecast Convective Activity*

- Tighten seatbelts and shoulder harnesses (all occupants).
- Secure all loose items.
- Turn up cockpit lighting to fullest intensity.
- In moderate or greater turbulence, reduce power to establish and maintain $V_A$
- Listen up for PIREPs.
- Ask ATC if there are any areas of moderate or greater precipitation along your route of flight.

*Avoiding Convective/Thunderstorm Encounters*

*Preflight*

- Ask what kind of weather system you might encounter.
- Are conditions ripe for squall lines, area thunderstorms, embedded thunderstorms?

*Inflight*

- Seek updates from AFSS Flight Watch
- Listen to chatter on the ATC frequency. Are there PIREPs? Requests to deviate or divert?
- Ask ATC if there are any areas of moderate or greater precipitation along your route of flight.
- Decide early whether to change course, land early, or fly to an alternate. Don't wait until the last minute!

*Inadvertent Thunderstorm Encounter—What to Do?*

- Concentrate on keeping the aircraft in a level attitude.
  - Allow the airspeed to fluctuate.
  - Allow the altitude to fluctuate—DO NOT attempt to maintain altitude!
- If equipped with an autopilot, disengage the altitude hold and constant speed modes.
- Fly straight ahead—avoid turning until you have exited the thunderstorm.
- Turn on pitot heat, carb heat, and any anti-icing or deicing equipment on board.

**Radar Limitations**

- En Route facilities (centers) cannot detect LIGHT precipitation.
- Some approach control facilities cannot provide precipitation intensities. In these cases, ATC will state: "intensity unknown."
- Most ATC facilities cannot distinguish between level 3 and 4 or between level 5 and 6 intensity.

**Controller Phraseology Examples**

Examples

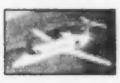
- "Extreme precipitation between eleven o'clock and one o'clock, one zero miles, moving east at two zero knots, tops flight level three niner zero."
- "Heavy precipitation between ten o'clock and two o'clock, one five miles. Precipitation area is two five miles in diameter."
- "Moderate precipitation between ten o'clock and two o'clock, one five miles. Precipitation areas is two five miles in diameter."
- "Light to moderate precipitation between ten o'clock and two o'clock, and one five miles. Precipitation area is two five miles in diameter."
- "Precipitation area between one o'clock and three o'clock, one five miles, intensity unknown."

**Suggested Phraseology for Pilots**

Examples for requesting weather deviation:

- "Nashville Approach, N123A, request 20 degrees deviation right of course."
- Cleveland Center, N123A, request radar vector heading to pass south of area of moderate precipitation."
- "Detroit Approach, N123A, request left deviation to avoid buildups."
- "Atlanta Approach, N123A, request assistance to avoid moderate or greater precipitation."
- "Los Angeles Center, N123A, request approval to deviate around weather for next 10 miles."

***Figure 2***



the weather data is updated. This is important to remember because convective weather is transient and can change rapidly. Thunderstorms can develop at rates exceeding 6,000 feet per minute, which is faster than the updates. To rely solely on ATC as a source for weather avoidance is not entirely prudent. It is the pilot's responsibility to obtain a preflight weather briefing. Any ATC reported weather information, along with periodic contacts with Flight Watch while airborne, will supplement what was learned during the preflight briefing, The ATC reports of precipitation areas are of value because they can give you a global view of what is in the area. Pilots who have on board weather radar or lightning detection systems can benefit from the big picture that ATC can paint and can use the aircraft's on board systems to pick the best tactical route to avoid severe weather.

ATC can tell you what is in your immediate path, but won't tell you what to do. It's up to you. ATC can tell you whether or not an area of precipitation awaits you and some can tell you if it is Light, Moderate, Heavy, or Extreme. It is up to you to decide what to do. Be prepared to tell ATC what you want to do. ATC can provide approval for you to deviate from your assigned course so that you can skirt around the weather yourself. Do you want assistance? ATC can provide you with a suggested heading to take you to one side or other of the weather, but remember, ATC radars cannot detect the presence or absence of clouds or turbulence, so the headings convey no guarantee that you will not encounter hazards associated with convective activity. If you wish to circumvent the area at a specific distance, you must make your desires clearly known to ATC at the time of the request for the service.

Rainfall rates are difficult to associate with the intensity levels because they can vary significantly depending upon whether they occur in convective or non-convective conditions. Since "Mother Nature" can be capricious, suffice it to say that in convective conditions, once you get near the Moderate range of precipitation, you should expect difficult conditions. All thunderstorms and convective activity should be expected to have turbulence associated with them. Operation in and around such conditions should be approached with great caution because the severity of turbulence can be markedly greater than the precipitation description might indicate. Turbulence should be expected to occur near such areas, even in clear air. A good rule of thumb is to give thunderstorms a wide berth.

## OPERATIONAL TIPS

State exactly what you want to do, or what service you want from ATC (See figure 2, previous page). Generally, when weather disrupts the flow of air traffic, greater workload demands are placed on the controller. Requests for deviations from course and/or radar vectoring services should be made as far in advance as possible to better assure the controller's ability to approve such requests promptly. Don't wait until the last possible moment. When requesting approval to detour around weather activity, it is helpful to include the following information:

(a) the proposed point where the detour will commence;

(b) the proposed route and extent of the detour (direction and distance);

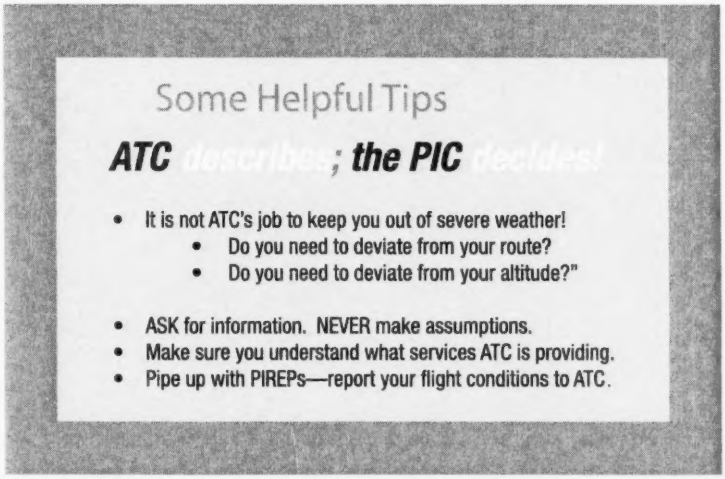
(c) the point where original route will be resumed (as soon as it can be determined); and

(d) any further deviation(s) that become necessary.

Thunderstorms and ATC is an excellent on-line program from the AOPA Air Safety Foundation containing more information for pilots is available at <http://www.asf.org/wxwise_thunder>.

## MAINTAIN SITUATIONAL AWARENESS

If you are flying an off course heading that is taking you around or away from bad weather and ATC issues you a clearance to resume on course or proceed direct to the next NAVAID when able, *maintain your situational awareness*. In other words, don't undo what you were trying to do! Ask ATC whether or not you are clear of the weather area if you don't already know. (See figure 3) If you turn to the direct heading too soon, you could very well put yourself on a direct course to enter the same weather that you were trying to avoid! ATC may be very busy, but double check with them. The controller can see where your aircraft is in relation to the precipitation area and where your heading will take you. ATC may be busy, but remember, your well-being is on the line, and no controller wants you to put yourself in jeopardy!


Some Helpful Tips
ATC describes; the PIC decides!
• It is not ATC's job to keep you out of severe weather!
• Do you need to deviate from your route?
• Do you need to deviate from your altitude?"
• ASK for information. NEVER make assumptions.
• Make sure you understand what services ATC is providing.
• Pipe up with PIREPs—report your flight conditions to ATC.

## COMMUNICATE!

If you are on an assigned heading or deviating on your own to avoid weather areas (with ATC's approval) and are switched to another controller's frequency, make sure that the next controller understands that you are deviating or are on an assigned heading to avoid a precipitation area. If you want continuing heading/vector services, make sure the controller understands what you want. Do not assume that the controller knows this! Reading minds is not one of the skills for which controllers are selected.

Use the In-flight and Flight Watch Service for weather updates. Flight Watch can tell you what the big picture is so that you can decide whether or not it's time to call it a day or continue the flight.

## PIPE UP WITH A PIREP!

PIREPs are one of the most valuable sources of information for pilots. Volunteer PIREPs for your flight conditions such as visibility, turbulence, icing, lightning, precipitation intensity, cloud tops/bases/layers. These reports can ease your or other pilots' travels through the system. So be a good sport and give a report!

## CONCLUSION

ATC's first duty priority is to separate aircraft and issue safety alerts. ATC will provide additional services to the extent possible, contingent only upon higher priority duties and other factors that include limitations of radar, and workload associated with volume of traffic and frequency congestion.

Generally, when weather disrupts the flow of air traffic, greater separation demands are placed on the controllers. Try not to wait until the very last moment before asking for deviations from course, or for assistance to get around or away from areas of severe weather. When severe weather is in the area, controllers will be very busy and may not be able to respond to your requests promptly. When encountering weather conditions that threaten the safety of the aircraft and its occupants, the pilot may exercise emergency authority as stated in 14 CFR 91.3 should an immediate deviation from the assigned clearance be necessary, and time does not permit approval by ATC. It is better to think ahead and be prepared so that you do not have to resort to emergency action.

*Christine Soucy is with FAA's Office of Accident Investigation, Accident Coordination Branch.*

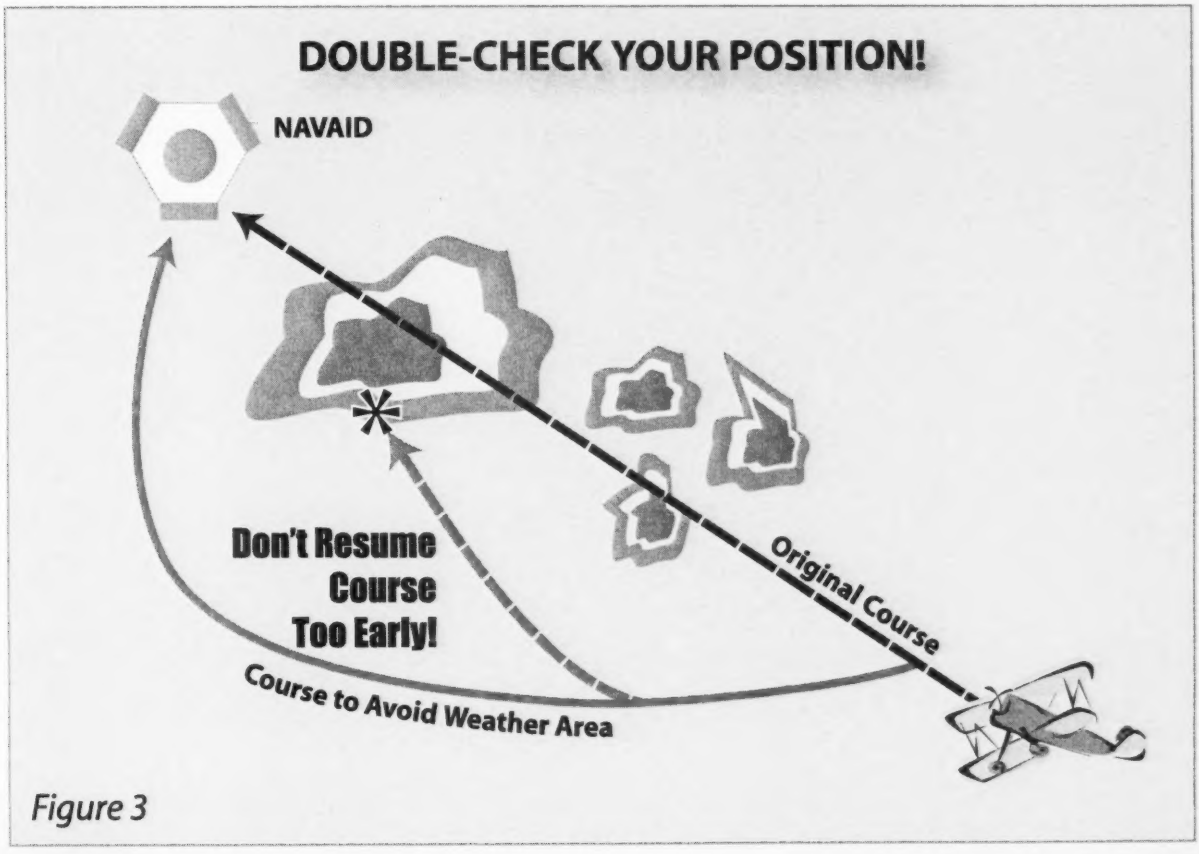
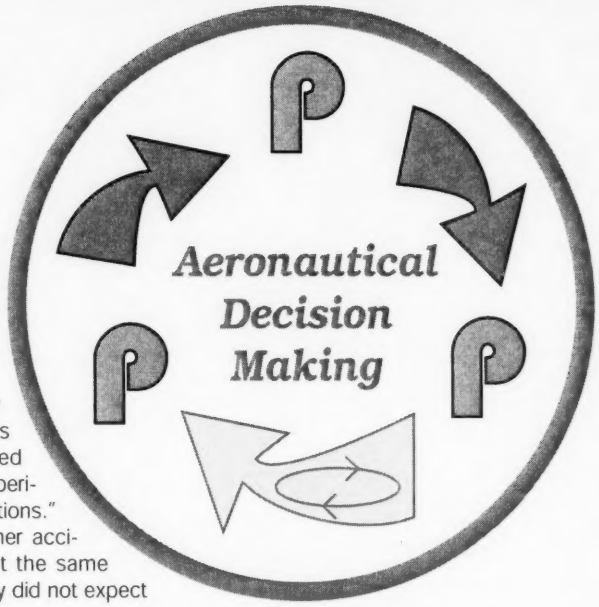



*Figure 3*

# Weather Decision-Making for GA Pilots

by Susan Parson




Aviation has come a long way since the Wright brothers first flew at Kitty Hawk. One thing that has unfortunately not changed as much is the role that weather plays in fatal airplane accidents. Even after a century of flight, weather is still the factor most likely to result in accidents with fatalities.

From the safe perspective of the pilot's lounge, it is easy to second-guess an accident pilot's decisions. Many pilots have had the experience of hearing about a weather-related accident and thinking themselves immune from a similar experience, because "I would never have tried to fly in those conditions." Interviews with pilots who narrowly escaped aviation weather accidents indicate that many of the unfortunate pilots thought the same thing — that is, until they found themselves in conditions they did not expect and could not handle.

Given the broad availability of weather information, why do pilots continue to be surprised and trapped by adverse weather conditions? Ironically, the very abundance of weather information might be part of the answer. With many weather providers and weather products, it can be very difficult for pilots to screen out non-essential data, focus on key facts, and then correctly evaluate the risk resulting from a given set of circumstances.

This article describes how to use the FAA Aviation Safety Program's **P**erceive – **P**rocess – **P**erform decision-making framework as a guide for your preflight weather planning and in-flight weather decision-making. The basic steps are:

—**Perceive** weather hazards that could adversely affect your flight by obtaining all the information you need for good situational awareness.

—**Process** this information to determine whether, and how, the hazards create risk to the safety of your flight.

— **Perform** by acting to mitigate the risk and evaluate the outcome of your action.

## *Preflight Decision-Making*

### *Perceive*

When you plan a trip in a general aviation (GA) airplane, you might find yourself telling passengers that you are first going to "see" if weather conditions are suitable. In other words, your first preflight weather task is to *perceive* the flight environment by collecting information about current and forecast conditions along the intended route. Flight Service and DUATS are the approved sources of aviation weather information, but there are many other resources that can help you get the maximum benefit from your weather briefing. A few suggestions:

✓ *Prepare.* If you have a basic idea of current and forecast conditions and weather systems before you call the Automated Flight Service Station (AFSS) or access DUATS, it will help you better absorb information and identify areas that require closer investigation or discussion with the briefer. Many pilots start by getting the big picture with televised or online weather, and then go to the National Weather Service's Aviation Weather Center <http://aviationweather.gov/> and Aviation Digital Data Service (ADDS) <http://adds.aviationweather.noaa.gov/> for aviation-specific information. ADDS also offers interactive tools that can help you better visualize weather conditions.

✓ *Review.* Using the standard flight plan form, develop an estimate for altitude, route, and estimated time en route so you can get the most appropriate information from the AFSS briefer or DUATS.

✓ *Be honest* – with yourself and with the briefer – about any limitations in pilot skill or aircraft capability. If you are new to the area or unfamiliar with the typical weather patterns, including seasonal characteristics, speak up.

✓ *Ask questions* – what you don't know can hurt you. The worse the weather, the more data you need, and you should definitely seek a "live" briefing from an FSS specialist before you head for the airplane. If you are flying in instrument metereological conditions (IMC) or marginal visual flight rules (MVFR) that could deteriorate, be sure to get information on which direction (north, south, east, west) to turn for better weather, and how far (or how long) you would have to fly to reach it. Also, don't forget to

check the pilot reports (PIREPs) – fresh information from someone who has actually experienced the weather conditions can add substantially to your weather picture.

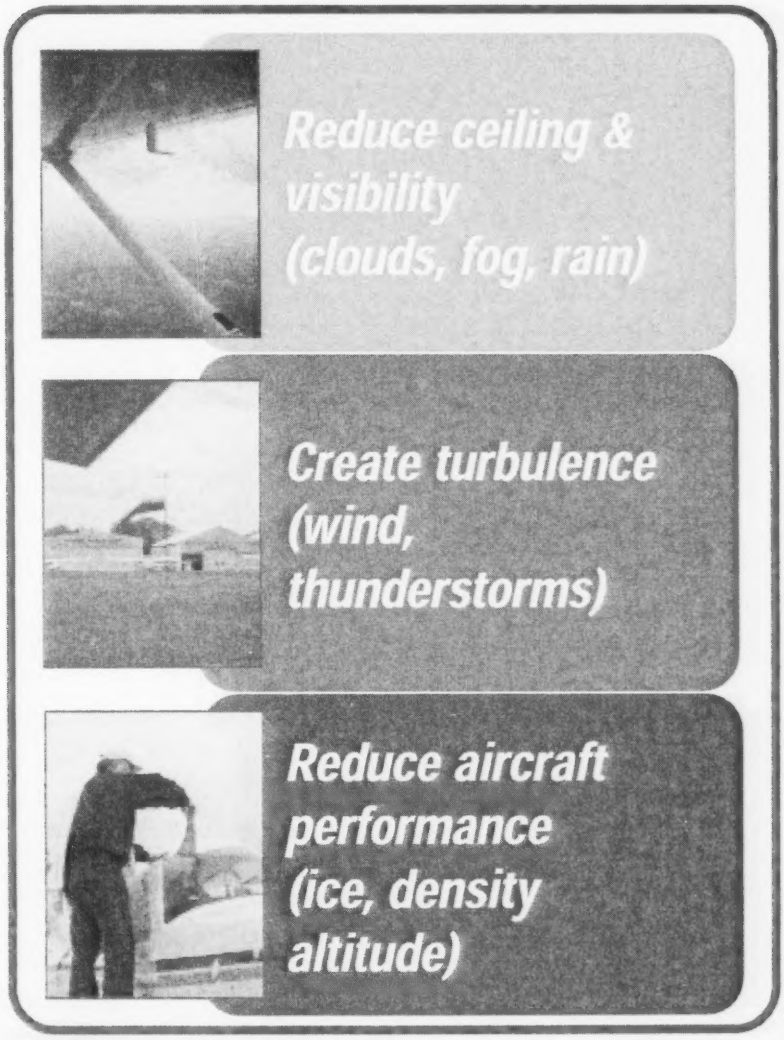
### Process

Fuel in your tanks is useless unless it is processed through the engine. Similarly, weather information in your hands is worth little, unless it is processed through your brain. Weather is certainly complex, but the good news is that you don't have to have a degree in meteorology to effectively and accurately analyze the weather information that you just obtained. Here's a simple way to start processing your weather briefing data.

As you might remember from ground school, the three basic elements of weather are: *temperature* (warm or cold); *wind* (a vector with speed and direction); and *moisture* (or humidity). These three weather elements combine in various ways to create conditions that affect pilots.

While the range of possible combinations is nearly infinite, weather really affects pilots in just three ways. Specifically, the basic weather elements can. (See below)

Consequently, you need to analyze your weather briefing data in terms of how current and forecast conditions will create any of these hazards for your flight. Use any method that works for you, but you might find it helpful to jot information from METARs and TAFs into a format like the tables on the next page. The columns match the order in which the weather data is presented, with labels along the top for the three major weather impacts. Make rows to record conditions for departure, en route, and arrival phases of flight. This method can help you make "apples to apples" comparisons, and to see at a glance whether, and how, the three weather impact conditions will be present for each phase of your flight. You might make a similar analysis of winds aloft.


Reduce ceiling & visibility (clouds, fog, rain)
Create turbulence (wind, thunderstorms)
Reduce aircraft performance (ice, density altitude)

Once you identify the weather issues for your flight, the final part of processing your information is to evaluate whether the pilot-aircraft team is up to the challenge. For example, you may be a very experienced, proficient, and current pilot, but your weather flying ability will be limited if you are flying a 1980s-model aircraft with no weather avoidance gear. On the other hand, you may have a new technically advanced aircraft with moving map GPS, weather datalink, and autopilot — but if you do not have much weather flying experience, never count on the airplane's capability to compensate for your own lack of experience. It also helps to compare conditions to your personal minimums (see May/June 2006 issue of the *FAA Aviation News*).

### Perform

The third step, making a preflight weather plan, is a strategic, "big picture" exercise that should include:

✓ *Escape Options:* Is there good weather within your aircraft's range and endurance capability? What direction do you turn, and how long will it take to get there? In bad weather, can you identify an acceptable alternative airport for each 25-30 nm segment of your route?

## CURRENT CONDITIONS (METARs)

| Weather Impact | | Turbulence | Ceiling & Visibility | | | Visibility & Performance | Trends |
|---|---|---|---|---|---|---|---|
| **Place** | **Time** | **Wind** | **Visibility** | **Weather** | **Ceiling** | **Temp/Dewpt** | **Altimeter** |
| Dep | | | | | | | |
| ENR | | | | | | | |
| Dest | | | | | | | |

## FORECAST CONDITIONS (TAFs)

| Weather Impact | | Turbulence | Ceiling & Visibility | | |
|---|---|---|---|---|---|
| **Place** | **Time** | **Wind** | **Visibility** | **Weather** | **Ceiling** |
| Dep | | | | | |
| ENR | | | | | |
| | | | | | |
| Dest | | | | | |

✓ *Reserve Fuel:* Knowing where to find VFR weather will help only if you have enough fuel to reach it. More fuel means access to more alternatives. It also spares you the worry (and distraction) of fearing fuel exhaustion when weather has already increased your cockpit workload.

✓ *Terrain Avoidance*: Always know how low you can go without hitting terrain and/or obstacles. Make a specific terrain avoidance plan for any flight that involves MVFR conditions, a temperature/dewpoint spread of 4° C. or less, any expected precipitation, or operating at night.

✓ *Passenger Plan*: Pressures such as the pilot's reluctance to appear "cowardly" or to disappoint passengers can be very powerful, so your weather planning should include preflighting your passengers. Suggestions:

- ❍ Share personal weather minimums with your passengers, and state up front that you will delay or divert if conditions exceed these values.
- ❍ Let passenger know what you will do if you have to divert at any particular point. Preflight is the time to think through alternative arrangements (e.g., hotel, rental car) in the event that weather conditions worsen.
- ❍ Advise anyone meeting you at your destination that you will call when you arrive, and that you will delay or divert if weather becomes a problem.
- ❍ Remember that waiting it out is one of the most effective safety tools. A single day can often make the difference between risky and routine.

### *En Route Weather Decision Making*

### *Perceive*

When weather is not severe enough to cancel the trip, many pilots choose to take off and take a look. If you make such a decision, safety requires staying alert to weather changes. At typical GA aircraft speeds, a 200-mile trip can leave a two to three hour weather information gap between the preflight briefing and the actual flight — and weather can change a lot. Use these sources of information before you take-off:

✓ *Visual Updates.* Use your eyes to see whether the conditions around you match the conditions that were re-

ported or forecast. If not, you need to start getting more information.

✓ *ATIS/ASOS/AWOS.* Listen to ATIS and ASOS/AWOS broadcasts as you fly. If conditions are worse than forecast, it's time to seek more information.

✓ *Enroute Flight Advisory Service (EFAS, or Flight Watch).* Available on 122.0 MHz in the continental United States from 5,000 feet AGL to 17,500 feet MSL (124.67 MHz at higher altitudes), call Flight Watch for en route weather advisories pertinent to the type of flight, route of flight, and altitude.

✓ *Air Traffic Control (ATC).* If you are not already on an IFR flight plan, monitoring ATC frequencies (available on aeronautical charts) along the way can tell you a lot. For instance, are other GA aircraft along your route deviating for weather? Having the ATC frequency tuned also makes it easier to request information and assistance.

✓ *Datalink and Weather Avoidance Equipment.* Datalink is an increasingly popular method of getting inflight weather information. Datalink uses satellites to transmit METARs, TAFs, NEXRAD, and other information to the cockpit for display on the multifunction display (MFD) or a handheld unit.

## Process

In order to properly evaluate and interpret en route weather information, you need to be aware of limitations such as:

✓ *Visual Limitations.* Research has determined that weather transitions are sometimes too subtle for the visual system. The human eye responds best to changes, including motion and light (e.g., flashing strobe). In deteriorating weather conditions, reductions in visibility and contrast can occur so gradually that the pilot does not notice until there is a significant reduction in visibility.

✓ *ATIS/ASOS/AWOS.* Inflight weather information obtained from ATIS and ASOS/AWOS broadcasts can contribute useful pieces to the en route weather picture, but remember that it is only a "snapshot" of a limited area in the airport vicinity.

✓ *EFAS.* Interpreting EFAS information while you are also flying the aircraft — especially in adverse conditions with no autopilot — can be very challenging. Keep a chart at hand so that you can quickly visualize location of weather relative to your position and route, and determine whether (and where) you need to deviate.

✓ *Air Traffic Control (ATC).* Be aware that radar "sees" only those entities that reflect energy. Precipitation density is indicated by the strength of the return and, while radar does not detect turbulence, an intense precipitation return may imply its existence. Similarly, icing does not show directly, but may be inferred by the presence of moisture, clouds, and precipitation at temperatures at or below freezing.

✓ *Datalink and Weather Avoidance Equipment.* Today's cockpit weather displays give pilots an unprecedented quantity of weather data, but datalink is not a silver bullet. The quality of the information depends heavily upon update rate, resolution, and coverage area. Accurate analysis of datalink information depends on your understanding each of these parameters.

## Perform

Your preflight weather plan is a strategic tool. Use en route weather data and analysis to make tactical ("right now") weather decisions based on what you actually find in the air. Suggestions:

✓ *Take action.* Act immediately if you see or suspect deteriorating weather. For example, head for the nearest airport if you see developments such as:

- Clouds forming beneath your altitude,
- Gray or black areas ahead,
- Hard rain or moderate turbulence,
- Clouds forming above that require you to descend; or
- Conditions below your pre-established personal minimums.

It is always easier to reevaluate conditions and make a new plan from the safety of an airport.

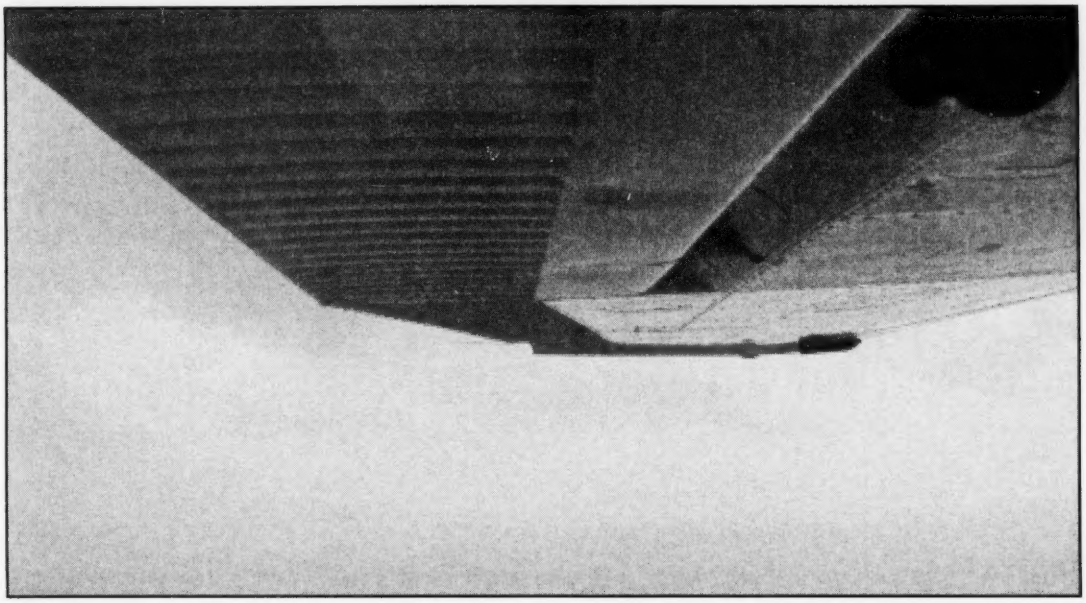
✓ *Don't delay.* If you need help from ATC in avoiding or escaping weather, ask sooner rather than later. Remember that navigational guidance information issued to a VFR flight is *advisory* in nature. Suggested headings do not authorize you to violate regulations, and they are not guaranteed to keep you clear of all weather.

✓ *Never assume.* Don't make assumptions about what the controller knows about your flight.

- If you are handed off while on a suggested heading for weather avoidance, confirm that the next controller knows you are requesting this assistance.
- Remember that to ATC, "cleared direct when able" means to fly direct when you are able to navigate directly to the fix. It does *not* mean that you are now clear of weather. Always ask whether a direct course will keep you clear of radar returns indicative of thunderstorm activity.

✓ *Help other pilots.* When ever your workload permits, contribute to the system by making PIREPs yourself. If you aren't certain about how to give PIREPs, take a look at the AOPA Air Safety Foundation's free online "Skyspotter" course (http://www.aopa.org/asf/ online_courses/skyspotter/), which includes a handy PIREP form that you can put on your kneeboard. If you don't have a form

handy, don't let that stop you from contributing — tell the FSS specialist or controller what you see so that other pilots can benefit from your experience.



### *Post-Flight Weather Review*

When you land after a challenging flight in the weather, you probably want nothing more than to go home and unwind. The immediate post flight period, however, is one of the best opportunities to increase your weather knowledge and understanding. Make it a point to learn something about weather from every flight. Take a few minutes to review and reflect by considering these questions:

✓What weather conditions/hazards existed, and how did they impact this flight?

Turbulence / Winds _____
Ceilings / Visibility _____
Aircraft Performance _____

✓How did the conditions encountered during this flight compare with the information obtained in the preflight and/or en route briefings?

✓Which source(s) of preflight weather information provided the best (or most useful, most accurate, most relevant) data for this flight?

✓Which source(s) of en route weather information provided the best (or most useful, most accurate, most relevant) data for this flight?

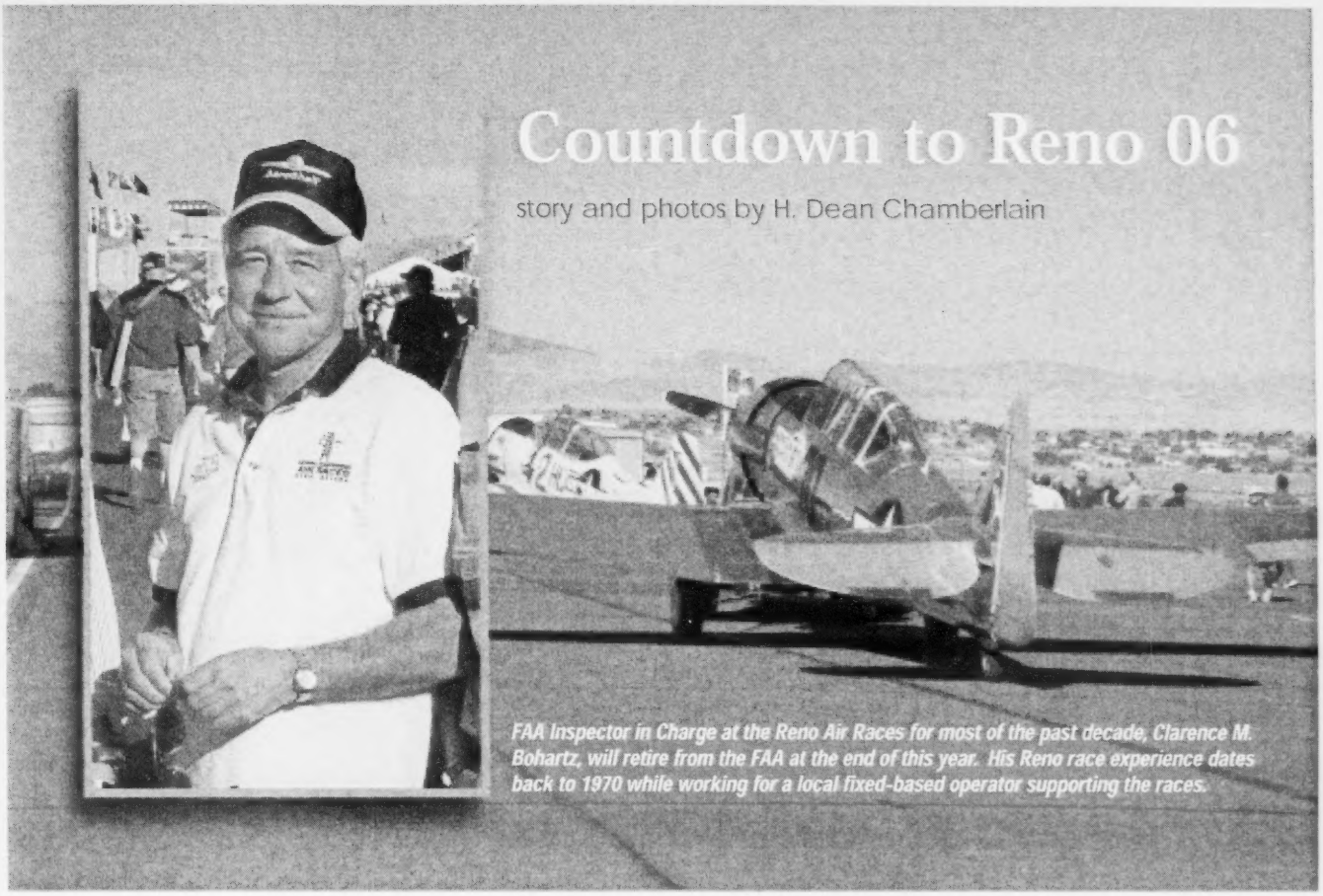
Weather is a fact of life for pilots. Developing your weather knowledge and expertise is well worth the time and effort you put into it, because weather wisdom will help keep you, and your passengers, safe in the skies.

*Note: For more information, please go to:*
*http://www.faa.gov/pilots/safety/media/ga_weather_decision_making.pdf*

*Susan Parson is a Special Assistant in Flight Standards' General Aviation and Commercial Division and is an active GA plot and a NAFI Master CFI.*

# Countdown to Reno 06

story and photos by H. Dean Chamberlain



*FAA Inspector in Charge at the Reno Air Races for most of the past decade, Clarence M. Bohartz, will retire from the FAA at the end of this year. His Reno race experience dates back to 1970 while working for a local fixed-based operator supporting the races.*

Check your calendar. If you love the sight and sound of unlimited piston-powered aircraft racing towards the checkered flag you need to be at the Reno Stead airport, a few miles north of Reno, Nevada, September 13-17. Those are the dates for the 43rd National Championship Air Races and Air Show. Reno Stead Field has been the site of the National Championship Air Races since 1966. Adding to the air show excitement this year will be the performance of the U.S. Air Force "Thunderbirds." Flying the F-16 *Fighting Falcon*, the Thunderbirds have performed for millions of people since their founding in May of 1953.

Although always subject to change, six classes of aircraft are scheduled to race this year. Each class provides an interesting contrast to the other classes. To paraphrase an old expression, there is something for everyone. As I have said in past years, the Biplane and Sport classes and to an extent the Formula One class are your "family" aircraft classes. If you walk through the Reno Air Racing Association (RARA) hangar where these aircraft are stored when not racing, you will find a surprising number of family members and friends working on these types of aircraft. A good example of one of those types of aircraft is your classic Pitts *Special* which competes in the Biplane class. The Biplane class races on the small 3.11-mile course at speeds up to 200 mile per hour (mph). The Formula One class also race on the 3.11-mile course, but at speeds up to about 250 mph. If you have the piloting skills necessary to race at Reno, the Biplane class and possibly the Sport class are within your average aviator's financial reach.

However, the Sport Class has more power and speed compared to the first two classes. The production kit-built Sport aircraft are limited to reciprocating engines of 650 cubic inches or less. Because of their faster speeds, Sport class airplanes race on the 6.39-mile course at speeds of more than 400 mph.

Another class is the T-6 class. These stock former military training aircraft with their Pratt & Whitney Wasp R-1340-AN-1 radial engines provide a same design type of racing at Reno. Because this is a one-type design class, when these U.S. built T-6 *Texans* and Navy SNJs, and their Canadian-built *Harvard* counterparts compete, pilot skill as much as performance counts. The T-6 class competes on the 4.99-mile course at speeds in the 200 mph plus range.

The Jet class is a relative new addition at Reno. Comprised of foreign ex-military trainers, these L-39 *Albatros* jet aircraft provide a glimpse into the future as more and more jet aircraft become available to the flying public. These aircraft use the 8.355-mile course.

The last class at Reno is probably the crowd's favorite aircraft. The Unlimited class means just that. Only two restrictions apply to this class.

One is type engine: It must be piston-powered. The second is weight. It must have an empty weight of more than 4,500 pounds. The rest is up to your imagination and the size of your bank account. This is where many of your World War II-type aircraft compete on the 8.355-mile course. These aircraft use some of the most powerful piston engines ever developed for aircraft. When you consider all of the modifications that can be made to these aircraft, some can hit speeds up to 500 mph. Although I have heard a few television announcers say in the excitement of a NASCAR™ stock-car race that the cars running that day are the world's fastest sporting event, obviously those announcers have never worked an Unlimited "Gold" race on the last day of racing at Reno. Last year's Unlimited "Gold" Race Champion was Rare Bear. Flown by John C. Penney, the F8F-2 *Bearcat* had an average speed of 466.298 MPH for the 67.29 miles it flew around the course.

During race week, pilots and their aircraft compete in qualifying heats up through the final races for each class that include "Bronze, Silver, and Gold" races with the "Gold" race for each class having the fastest qualifiers within that class. The challenge for each aircraft is having the speed and endurance to finish each race. From blown engines to cutting a pylon—aircraft, pilots, and crews work hard to meet the race schedule. Like any race, it is not necessarily the fastest aircraft at the start of the race that wins, but the one that can finish first.

"Maydays," although infrequent, do happen. The most common cause of a "Mayday" on the course is probably a blown engine and the problems that come with that, such as an oil covered windshield, possible engine fire, or aircraft damage. In most cases, the pilot is able to land the stricken aircraft back on one of the runways that underlie the race courses. In some cases the pilot may have to land off the airfield. Regardless of what the emergency is or where the aircraft is landed, there is a detailed emergency response plan in place to respond to any type of emergency. From medical personnel to rescue experts to aviation firefighters with their specialized trucks to helicopter crews standing by their aircraft, safety is a way of life for the pilots, crews, and support folks during race week. Another example of the safety support provided the pilots is air cover. Another aircraft may be flying over the course during a race to respond to any "Mayday" calls. The cover aircraft then follows the stricken aircraft and provides what assistance it can provide the "Mayday" aircraft until it is safely on the ground. In the case of an off airfield landing, the cover aircraft will monitor the landing and guide rescue support to the landing site.

Although most publications highlight the aircraft, their pilots, and sponsors, *FAA Aviation News* is unique. We focus on the safety aspects of the event and the important role the Reno Flight Standards District Office (FSDO) plays in the races and air show. Leading the FSDO effort at any type of aviation event is the Aviation Safety Inspector in Charge (IIC). Aviation Safety Inspector (Operations) Clarence Bohartz has been the IIC at the races for most of the past decade. Leading a team of FAA inspectors, Bohartz is responsible for ensuring that the FAA safety requirements are complied with by the pilots, aircraft, and race sponsors. As I have said in past years, the working relationship that Bohartz and his team has with the race organizers and participants is a truly outstanding example of how industry and FAA can work together for the safety of all involved.

Although every event sponsor is responsible for all of the safety aspects of the event, the Reno FSDO aviation safety inspectors and support staff work closely with representatives from RARA, the event sponsor, throughout the year to ensure that FAA safety requirements are identified and addressed. As with any aviation event that requires special airspace usage, each year RARA submits to the FSDO a detailed request asking the FAA to waive certain regulations. These include, for example, a waiver of the airspeed restrictions for aircraft below 10,000 feet MSL (14 Code of Federal Regulation (14 CFR) section 91.117). Although the FAA may waive specific regulations, each request is reviewed for an equivalent level of safety. Whenever a waiver is issued, safety is not compromised. If you are planning an aviation event, 14 CFR part 91, Subpart J, Waivers, lists those rules subject to waivers. Not all rules can be waived. As stated in part in section 91.903, Policy and procedures, the Administrator may issue a certificate of waiver if the proposed operation can be safely conducted under the terms of the waiver. Section 91.905 lists those rules that can be waived. Some of these include airspace, speeds, altitude, operating near other aircraft and aerobatic flight among others. In the case of the air races, by restricting public access to the airspace during the races by a *Notice to Airmen* (NOTAM), FAA provides an equivalent level of safety to those participating in the races as well as protecting transit aircraft by prohibiting their entry into the area. In addition to reviewing and approving the annual waiver, FAA operations and airworthiness inspectors will check the pilot certificates and aircraft documents of those participating in the races and air show to ensure compliance with the appropriate regulations.

RARA has built up a great reputation over the years with the FAA and the Reno FSDO for how well it conducts the air races and air show. But safety does not start the day of the races. Safety and planning is a year round activity. The FAA waiver is one aspect of the races. From crowd control lines, the FAA specified minimum distance standards from the race course aircraft and the air show performers' aircraft, designed to protect the public in case of an aircraft accident to pilot briefings to fire fighting support, RARA has a detailed plan for every aspect of the races and the air show. But safety planning does not stop on the ground. A critical element of the races is the qualifications and competencies of the pilots com-

peting. RARA has stringent rules outlining how pilots can qualify to compete. The races are invitational. Only those pilots who meet RARA's training and experience requirements are invited. Each year in June, RARA holds a special training program at the Reno Stead Field to qualify pilots interested in competing as well as those qualified pilots who want to move to a different race class or who want to test fly their aircraft on the course. Known as the Pylon Racing Seminar, this year, the ninth Pylon Racing Seminar was held June 15-18. The training includes ground school, formation flying, Reno Pylon Race Simulation Flying, and a check ride by a racing class check pilot. The seminar is required for anyone who has never raced at the National Championship Air Races in Reno, raced in a different race class at Reno, or who has not raced in the same race class in Reno in the past three years. As noted on the Pylon Racing Seminar Internet Web page, "This is a pilot certification program, not an aircraft qualification period. Although it is recommended, a pilot need not fly the plane he/she will race; however, any aircraft used must be of the same class for which the certification is being sought."

In talking to pilots in past years, none want to race against anyone not capable of safely flying the course. Racing has its own unique risks. At the low altitudes and high speeds these aircraft fly, a mistake can be deadly. Pilots must be able to trust those they are competing against not to make a rookie mistake. Although the basic flight rule can be summed up as fly low, go fast and turn left, pilots must be prepared for any situation. From a sudden wing tip vortex upset to a blown engine to wings touching, pilots must be prepared to handle the unexpected.

One way pilots prepare for the course is the required daily pilot briefings. Each morning before the races start, the pilots are briefed on the weather and wind conditions expected during the day, any issues requiring their attention such as any last minute schedule changes, and any potential safety issues. Since each racing class has its own unique racing and safety issues, separate class meetings are held to discuss to them.

Like any well orchestrated performance, the pilots, ground crews and RARA volunteers all work hard to make the races a success. And like any well rehearsed orchestra, the RARA team of volunteers—such as time keepers, pylon judges, operations and fire, crash, rescue crews—all work together to keep the planes and pilots on a tight flight schedule. As one race is finishing, the next group of racers are preparing to launch while the just finished group is refueling. Making all of this happen are the ground crews and tow crews preparing and moving the planes for each flight. Like a well-trained flight deck crew on a modern aircraft carrier, each person has a specific job and each does his or her job quickly and professionally. It is amazing how fast an Unlimited ground crew can change a blown engine. Last year, I watched a crew modify the air intakes in the wing roots of one of the Unlimiteds. From concept to applying the final fiberglass modifications, the time needed was only a matter of a few hours, and most of that time was spent waiting for the fiberglass to cure. If the Biplane class is your family class, the Unlimiteds are your big-dollar babies. Although the competition is fierce in every race class as well as colorful, the Unlimited class is where teams, not individual owner-pilots or even families, compete. Rather than individual pilot-owners working out of a small tool box on their aircraft in the RARA hangar, many of the Unlimited teams come with complete mobile work shops with every imaginable tool or part possibly needed to race as well as one or more spare engines all being transported in color-coordinated semi-trailers that match their aircraft's color schemes. Add in the color-coordinated crew uniforms and jackets and you can begin to see how serious these teams are in winning.

To see and hear the excitement of the fastest motor sport racing in America, go to Reno in September, you will be glad you did. And if you are down in the Pit area, stop by the FAA trailer and say hello to the Reno FSDO inspectors. And if you see the IIC, say a special good-by to Clarence Bohartz. This is his last race week at Reno. He is planning on retiring from the FAA at the end of this year. When asked for his advice about what are the critical elements in organizing an air race, he said, "You need clear airspace; a good crash, fire, rescue plan; classes for pilots on how to run the course; clearly marked crowd control lines; and most importantly, since you need volunteers to make the event a success, you must provide training for the volunteers on what they are suppose to do and how they are to do it." Volunteers are the key to any successful event, he said. Treat them well.

Because of the popularity of the National Championship Air Races and Air Show at Reno, air racing is once again gaining in popularity in other parts of the country. The types vary from Formula One racing to one of the newest forms, the international Red Bull™ races. In the Red Bull™ races, single aircraft compete for the fastest time over a designated course through gates and around pylons, including completing specific aerobatic requirements while on the course. The pilot with the fast time while completing all the requirements wins. The newest type of air racing that is supposed to start in 2007 is rocket racing. The Rocket Racing League will feature a one-type design aircraft known as the *Velocity*. Similar in looks to the Burt Rutan designed *Long EZ*, the *Velocity* will be rocket powered. Not only are the airplanes' engines different, but so is the race course. They will race on a virtual course. The pilots will fly an electronically-generated cockpit displayed race course. For more information about the Rocket Racing League and the other types of air racing, you can check the Internet.

For detailed information about the 2006 National Championship Air Races and Air Show and the Reno area including lodging, you can check the following Internet Web site at <http://www.airrace.org/indexJS.php>

# Fuel Low

## *"Been there, done that, got the T-shirt"*

by Harlan Gray Sparrow III

Yeah, I know. How could anyone run low on fuel, especially if they had done any flight planning at all? Well, I have a long list of reasons, starting with unforecast head winds, engine runs rich, fuel gauge shows more fuel than is in the tank, aircraft is a rental, aircraft isn't rigged right, forward CG, mixture cable is out of adjustment—the list is probably endless. My all time favorite is the refueler didn't fill up the tank. Duh!

Since I have one of the "Fuel Low" T-shirts, I will share with you how I plan on not getting another one. Oh, I guess you are wondering how I got mine. Well, there I was making an over water flight from Jamaica to the United States and encountered an unforecast headwind. Instead of landing on an island en route, which would have been an unpleasant option (Customs), I continued on to my destination. I informed ATC at my destination that I was "minimum fuel." They acknowledged and said I was number six for the approach. Fortunately, I got cleared for the approach and landing before I had to declare an emergency. From then on, when in doubt, I have stopped for fuel, but that's not the only way to avoid it happening again.

Now having trained in the military, I learned a couple of things about how to do flight planning. Later on, one of my first civilian instructors, Larry Joe Yon, tried very hard to instill in me the importance of flight planning the civilian way. As it turns out, fuel on board, no matter whether you are civilian or military, is all the same. Larry was patient with me and was able to convince me of the importance of having a plan and then flying your plan. He reminded me to be careful to check and recheck my flight plan estimates en route in order to be able to make timely adjustments. Not really a hard concept to grasp, if you set aside your ego and a little hard headiness. Larry further stressed that flight planning doesn't just stop at looking over the chart and picking airports to stop for fuel. Today, more than ever, it would pay to call the airports to check on fuel availability and, of course, method of payment. A visual check of your fuel tanks after refueling is a must. The only accurate fuel gauge I know of is the one that says empty when the engine quits. By the way, GPS is probably one of the best additions you could have in your aircraft today. The accuracy of these devices sure makes flight planning an easier task while providing numerous options in the way of available airports en route.

Over the years, I have attended numerous safety seminars, many which were targeted at flight planning. You would think that the FAA and other safety oriented groups would finally get tired of talking about flight planning and fuel management. Well, it seems that in spite of their efforts, we (that's all of us pilots) still manage to run low on fuel, run out of fuel, or mismanage fuel. The latest *NALL Report* (courtesy of AOPA Air Safety Foundation), which shows accident trends and factors for 2004, indicates that there were 79 (four fatal) accidents as a result of fuel exhaustion. Although easily preventable, there were 39 (seven fatal) fuel starvation accidents as well in 2004. It would seem there is a trend, because in 2003 there were 90 (nine fatal) accidents as a result of fuel exhaustion and 41 (five fatal) accidents caused by fuel starvation. There is a simple answer to all of this. Rule Number One: plan on landing with at least one hour of fuel on board. This is on top of any regulatory requirements that may be in effect such as day, night, VFR, IFR, and alternate. Now I realize that if it were that simple we wouldn't have so many fuel related mishaps.

Every year there are many thousands of us who travel to and from Lakeland, Florida, (Sun & Fun® Fly-In) and Oshkosh, Wisconsin (EAA AirVenture® Fly-In). Unfortunately each year several pilots will earn a "Fuel Low" T-shirt. As my friend used to tell me, "when in doubt, duck, or in this case refer to Rule Number One."

This article is dedicated to all of the flight instructors out there who have made a difference.

*Harlan Gray Sparrow III is an Aviation Safety Inspector in Flight Standards' Air Transportation Division.*

# Introducing the Federal Aviation Administration Safety Team

By Kevin L. Clover

The FAA Safety Team (FAASTeam) will be launched on October 1, 2006 coinciding with the sunset of the FAA's Aviation Safety Program (ASP). The ASP's shotgun approach of educating airmen on all types of safety subjects has been successful at reducing accidents in the past. However, the easy to fix accident causes have all been addressed. In other words, the "low hanging fruit" has been harvested. To take aviation safety one step further, Flight Standards Service created the FAASTeam. The FAASTeam is devoted to reducing aircraft accidents by promoting a cultural change in the aviation community toward a higher level of safety.

To further reduce accidents the FAASTeam will use a coordinated effort to focus resources on particularly elusive accident causes. This will be accomplished by data mining/analysis, team work, instruction in the use of safety management systems/risk management tools, and development/distribution of educational materials.

There's plenty of data available on aircraft accidents, but it's often difficult to determine exactly what should be done to reduce accidents from the data. The FAASTeam is developing a Web-based Data Mart specifically designed to bring each FAASTeam Program Manager (FPM) the correct data for his/her geographic area. This will include accident data for airmen who live in the area, but actually had an accident in another area. This is a important new concept. In the past, accident data was summarized by where the accidents occurred. Programs to address those accident causes were developed and delivered in that area. But, the airmen who had the problem and others like them are not there to receive it. The FAASTeam will reach these airmen in their home areas. We're not likely to catch them hanging around the accident site.

FPMs will be trained to analyze the data and extract systemic and human factors problems that need to be addressed. The problems identified will be combined with information from local FAA inspectors who certify and perform surveillance on airmen and air operators. Together this data and information becomes the FPMs source data. The source data will be used to develop topics and tasks that the FPMs will weave into an annual business plan of actions. Regional FAASTeam Managers (RFM) will coordinate and prioritize the actions of their FPMs into a cohesive and efficient regional plan. All of this effort is designed to insure that resources are devoted to activities that will have the biggest effect on the safety culture and accident rate.

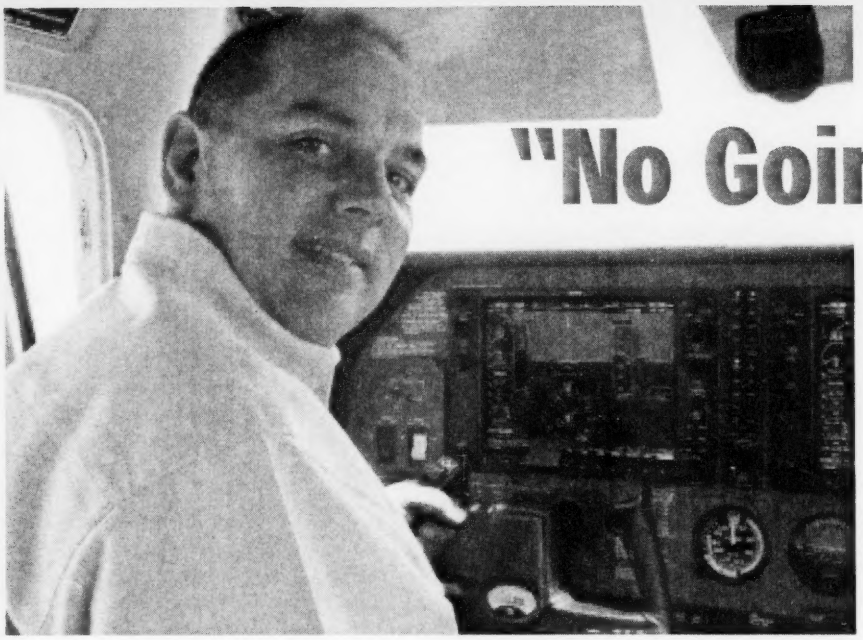
Team work will allow us to multiply our efforts beyond what the FPMs can do alone. The FAASTeam will develop symbiotic relationships with individuals and industry groups that have a vested interest in aviation safety. These individuals, FAASTeam Representatives, will work closely with the FPMs to "touch" airmen with our safety message on a local level. The FAASTeam will "team" with the aviation industry to bring aviation safety to airmen on a broader scale. The coordinated effort of all these FAASTeam members is what will cause the safety culture to "tip" in the right direction.

The FAASTeam will bring System Safety to many segments of the aviation community that have not experienced it before. Aviation operators such as flight/mechanic schools and repair stations identified to have higher risk levels will be provided with training on how to develop their own Safety Management Systems including the tools necessary to set up their own system. Individual airmen will be provided risk management training and tools via live seminars conducted by FAASTeam Members and the Web application at <www.FAASafety.gov>.

New products for airmen and air groups are being developed. Although they cover many aviation topics, they focus on showing airmen how they can change their behavior to be consistent with the new safety culture. Many products will be developed by working with our industry FAASTeam members and others will come from our National Resource Center (NRC). The NRC is collocated with the FAA Production Studios in Lakeland, Florida. This facility has the ability to take new product ideas from any of our FAASTeam Members and turn them into safety products in a variety of media. Then, they are duplicated, stored, and shipped (or beamed via satellite) whereever they are needed.

The Flight Standards Service has always been a world leader in aviation safety. Launching the FAASTeam is one more strategic step in supporting the FAA Administrator's goal of having the safest aviation system in the world. Go to <www.FAASafety.gov> for more information about the FAASTeam and sign–up to receive important aviation safety information via e-mail. It's the first step to becoming part of the FAASTeam.

*Kevin L. Clover is Flight Standards Service's National FAA Safety Team Manager.*



# "No Going Back"

By Mike Gaffney, MCFI

In the past two years, general aviation has had its share of technical revolutions. Consider the introduction of the G1000 glass cockpit and the Avidyne Entegra that have dominated modern general aviation cockpit design since 2004. Also consider the fact that the autopilots being used in these aircraft have also increased in their complexity severalfold in the same period. The combination of these two aspects of aircraft operation used to be only thinkable for business aviation, but the recent trends in general aviation design and the advances in avionic design have left us with aircraft that can quickly go faster than our brains. Most manufacturers and some insurance companies have recognized the need to rethink training strategy for new owners and operators of these aircraft. However, the industry consumers have become obsessed with the new panels without seeing a need to invest in the migration to more advanced training techniques, unless they are compelled to do so. There are two types of pilots that we want to explore in this article: Traditional round dial analog panel trained pilots (like most of us) and those who are currently learning to fly on glass cockpit Technically Advanced Aircraft (TAA). This article will consider the effect of these new technologies on pilots and their ability to handle various flight scenarios depending upon which panel was their primary training platform.

When the glass paneled cockpits started to appear on general aviation aircraft in 2003 and 2004, the FAA and industry created a series of workgroups and panels to look at how our current time tested training techniques would hold up in light of the changes that were inevitable with advances in technology and speed. One of the things that the FAA was interested in was whether the Practical Test Standards (PTS) were sufficient to test pilots ability to handle the new panels, especially in IFR conditions. They quickly realized that there were many differences in the piloting technique for a TAA aircraft and that changes were going to be required, not only to the PTS, but also to many of the supporting training books, such as the *Instrument Flying Handbook*, FAR/AIM, and flight instructor training materials. But what changes? How can you pinpoint what needs to change when the most fundamental aspect of the aircraft-human interface, the instrument panel, was changing its paradigm from a well understood analog interface to a digital color interface supplemented by computer inference? The problem became apparent that it was not just the panel changing, it was the entire interface that changed, and with that interface change comes the requirement for training technique changes, as well. The training technique employed must still embrace the classic panel design because there are so many of them still active in aviation today. To ignore the new technology for current flight training is less than responsible because the likelihood is that a pilot will encounter it sooner or later anyways.

FAA/Industry Training Standards (FITS) was designed by an industry consortium of stake holders to try to address this problem before it manifested itself in accidents which would bring burdensome regulation. It is in the process of being rolled out from the FAA in Washington to the FSDOs as a way to meet the higher demands of the new cockpit designs. I have talked about FITS and its basic definitions in previous articles so I will not elaborate on its structure in this article, except to state that it is different from traditional training techniques because it focuses on using realistic scenarios in a student centric fashion for every lesson which reinforces longer term learning and promotes safe operating practices.

Now by its original design, FITS was designed to do glass cockpit TAA training, but now some proactive organizations are refocusing it to teach basic primary and instrument skills. This is essential for two reasons. First, it is believed that FITS training techniques, if properly deployed, can help to lower the general aviation accident rate that has stagnated for nearly 15 years. Second, because of the rapid industry-wide acceptance of the G1000 and Avidyne Entegra cockpit panels in new production aircraft, many persons now learning to fly may be doing so in TAA aircraft right from the start. The FAA and other interested parties, such as NASA, have contracted research think tanks—

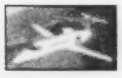
such as Embry Riddle Aeronautical University, University of North Dakota under the direction of Dr. Charles Robertson, and Middle Tennessee State University under the direction of Dr. Paul Craig—to research the FITS training philosophy. These organizations are involved in statistical evaluation of the effectiveness of FITS tenets. It is believed that there is statistical proof that FITS is effective and there is a direct correlation between training using scenario-based instructional techniques and the retention of safe operating practices by those who learn using these techniques.

But not everybody is convinced yet. To date, few schools have jumped on board. Perhaps it is the cost of redesigning existing training programs, or maybe it is the cost of retraining flight instructors to teach using a different instructional technique. Just how different is it to teach using FITS scenario-based techniques and why have most Part 141 and nearly all Part 61 flight training operators been so slow in adopting these new techniques? I have heard some grumbling from flight training types that FITS is just an excuse to put another layer of approval bureaucracy in an already over-regulated flight training industry. The industry has also witnessed flight instructors going to factory FITS accepted training programs only to return the TAA aircraft to the new FBO home and pile other CFIs in the cockpit and "ride around for several hours pushing buttons and twisting knobs" and calling this instructor standardization. This smells like old thinking to me and, if it keeps up, it is only a matter of time before an accident or a series of them causes our regulators to knee-jerk us into another logbook endorsement, such as the complex, high altitude, and high performance endorsements already required by Title 14 Code of Federal Regulations (CFR) section 61.31.

The hopes were that the industry, using the insurance companies as the watchdog, would ensure voluntary compliance with the stricter and far more effective training techniques that use student centric scenarios as a way to induce more permanent learning. But this has been slow to develop. Avemco and Phoenix Aviation underwriters both have taken an active role in using FITS training techniques as a yardstick of pilot proficiency. But there still is no industry wide consensus about who needs FITS training and when it needs to be done and exactly who is qualified to give it.

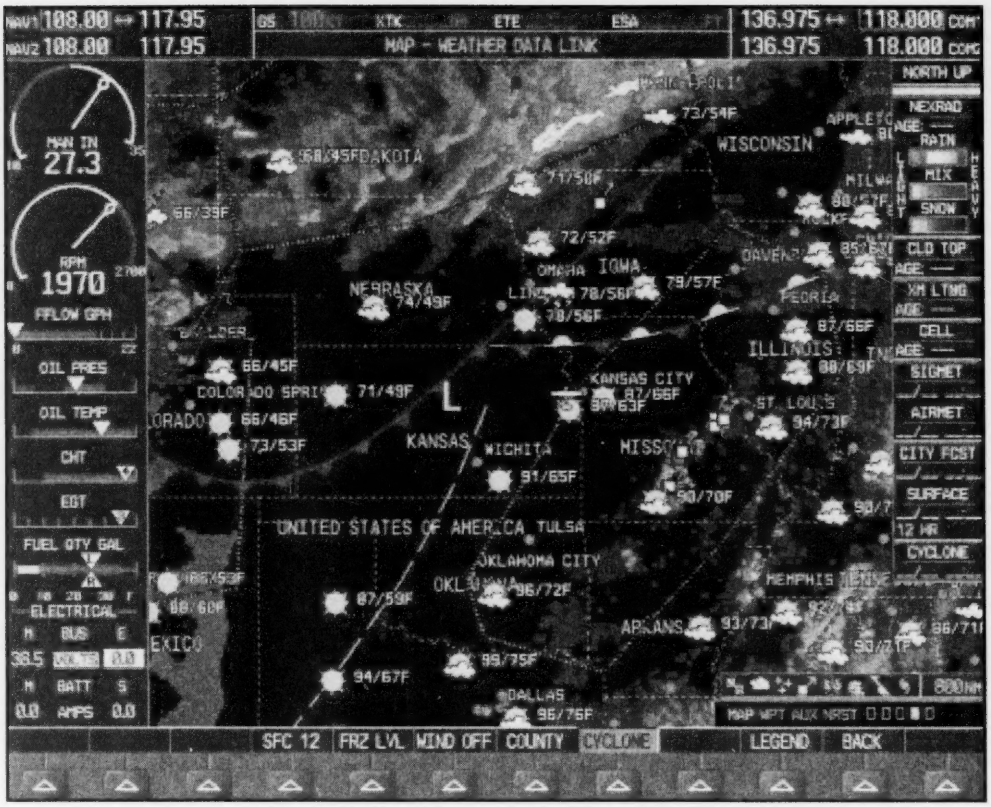
Skyline Aeronautics in St. Louis has devoted itself to developing and delivering FITS Accepted TAA cockpit training to anyone who will operate these aircraft. The FAA knows this and so do the insurance carriers because we get referrals from all over the country to take our FAA Part 141 and FITS Accepted G1000 and Avidyne Entegra training programs. Those who come here for these programs know that we are serious about training people using scenarios. The ground school for both of these programs is scheduled for eight hours, but frequently, the class goes for nearly 10 hours in order to get all of the material covered and to address specific questions arising from people's actual experiences. One might ask what you could possibly talk about for 10 hours. The answer is that in order to teach a pilot to operate a technical cockpit and to properly and safely understand the modes of the autopilot, it takes that long. Why? The operation of these panels is not like operating a VCR. There are no unimportant features. It is too easy to get drawn into the colors of the multifunction display rather than looking out the window. We find that even experienced pilots can spend close to a minute trying to "bump-scroll and twist" their way through a series of menus trying to set up an approach or trying to get the autopilot to properly couple. As the speed of aircraft continues to increase over 200 knots, thanks to composite design techniques, we find that using the trial and error method of cockpit management is no longer acceptable for flight safety. The aircraft covers too much distance over the earth while the pilot is engrossed with trying to figure out how to do something in the cockpit that they should have learned before they ever climbed in the left seat. The result is that the pilot falls behind the aircraft and then risks of mistakes pile up. I call it syncing up brain and airspeed. You can call it whatever you want.

Another major portion of the ground training class is dedicated to the understanding of the electrical system. When I was taught to fly I learned very little about the electrical system. I did not really learn it until I got my Aircraft and Powerplant (A&P) mechanics certificate several years later. In modern glass cockpit aircraft, the electrical systems have been reinforced with dual alternators, backup batteries and split avionics master switches, bus ties, and essential bus isolation relays. Some aircraft have test positions and procedures for the backup batteries and some use an ELT-like battery to operate a standby gyro in the case of electrical failure and have no connection to the rest of the electrical system. It is no longer common sense to train people to operate aircraft without spending time understanding the electrical nervous system and how to handle anomalies. How can a pilot exercise good aeronautical decision making if they do not know how the aircraft works in various normal and emergency scenarios? Now, we are not expecting pilots to be mechanics, but we are expecting that before they take an aircraft on their personal, pleasure, or business excursions they equip themselves with the knowledge of how to identify and handle the most common problems that can arise. "Remember Apollo 13," I tell them. When the unexpected failure happened, it was a detailed knowledge of the crafts system and their execution of load shedding procedures that made the difference of success and disaster. Flying solid IFR through rough weather is not the time to be leafing through a pilot operating handbook trying to figure out what is going on. After all, turbulent, moist weather might be the most logical but least welcome time for a loose wire or connector to show an intermittent



warning or caution.

We believe in the FITS way of teaching and we think you should, too. We have been getting calls from pilots who want to rent our G1000 aircraft and claim they were "trained" elsewhere. My customer support team knows the next question to ask. "Please present us with a copy of your FITS course completion certificate and we would be happy to rent you the aircraft." "I did not get one of those," one pilot said. He said he sat in a classroom for three hours then took one checkout flight in this G1000 equipped aircraft and he was cleared to go. Sorry, I told him. That does not cut it. He could not understand why, since he already had time in the aircraft. Time in the aircraft is not the same as dutiful preparedness.




*If you have the appropriate equipment onboard and the required services, a Garmin G1000® Multi-Function Display (MFD) can bring weather into a general aviation cockpit.*

The answer is simple, but the issues are complex. Let us explore several different pilot experience scenarios and look at the ways in which FITS training techniques can be employed in each instance.

First, the traditional pilot trained in an analog round-dial aircraft who decide to transition to the TAA glass-paneled aircraft. This sounds like most of us, myself included. After flying for 28 years and working in the computer field for 23 years, I discovered the joys of the glass cockpit panels and realized that there is truly a difference between situational awareness and electronic situational awareness. Situational awareness (SA) is the pilots overall ability to apply aeronautical decision making as the flight progresses because they remain vigilant of the current surroundings of the aircraft and know how to remain safely within flightplan parameters. Electronic Situational Awareness (ESA) occurs when the aircraft using its technology provides the information to the pilot by rendering relevant information on the screens such as weather, wind-drift, flight-plan, terrain, and traffic. All the pilot has to do is remember how to call those functions up on the screen when needed. Because of the GPS, skills involving chores that the pilot used to do in VFR by staring out the window and relating what they saw to the map in their lap have gone flat. In IFR, skills involving interpretation of VOR CDI needles and ADF indicators and relating that information to their perceived flight plan are falling into disuse. Is this becoming a lost art? It may be, if you don't keep up with it. It has become so easy to use GPS to get where we need to go, that many of us might be at risk of complacency of our basic IFR survival skills. Now this might be acceptable if we never have a systems emergency or alternator failure while on a night or IFR flight, but who can guarantee this? Flying is risk management and every time we take off in less than perfect conditions, Murphy and his laws are riding along waiting for us to lower our guard.

Now, because of my business, I frequently spend time in both types of cockpits, so I consider myself proficient in both TAA glass and traditional analog panels. What about other pilots who do not have the pleasure of making a living surrounded by aircraft? We have discussed the issue that many insurance companies require FITS training in order to complete that transition from traditional to glass, but is there a time limit that might be voided before they can safely move back to a conventional cockpit and take it into challenging conditions, such as IFR and night flight? Many pilots who I have talked to indicate that they could not fathom purposely moving backward in technology because

they feel spoiled by the glass paneled technology. That is just the point. What happens on the one day that you "have" to make the trip, but you can't get the TAA aircraft you have counted on. Now the pilot must make the hard decision. Stepping back into the classic aircraft to make the trip or not. You may be IFR current, but are you round-dial analog-panel IFR current? There is a difference.

I recently talked to a renter pilot who completed our FITS TAA training program and frequently takes a DA40 *Diamond Star* equipped with a G1000 glass cockpit on his trips. He told me that he just completed a trip where there was significant weather between Michigan and St. Louis. He made the trip with confidence because the weather was constantly onscreen with the GDL69 installation and the Stormscope. He further said he was using the fuel range rings to assist him enroute doing fuel reserve analysis as he discovered the headwinds were significantly stronger than FSS told him to expect immediately prior to departure. He told me that he would probably not have made the trip in the 310 he used to fly at another FBO. He was actively using the very scenarios we devised into the course and applying the data presented to make safe and intelligent operational decisions. After several years of flying the G1000, would he be ready to jump in that 310 and drive into hard IFR or a moonless sky?

In our TAA Aircraft course completion ride, I use a four airport scenario. The first airport is a VFR arrival at a class D airport with a touch and go and a VFR departure. The second airport is an ILS to a published missed approach to a holding pattern. This is where I dim the MFD simulating an alternator failure and watch the pilot try to figure out how to do an intersection hold with no on screen map and just the CDI and DBAR on the HSI. Hmmm, same results time after time. The pilots get lost interpreting the CDI and figuring out how to set up the "To" and "From" of the two defining VOR radials. A loss of Electronic Situational Awareness and inadequate working memory of the IFR basics leads to a potentially dangerous situation. I know they were taught it when they got their IFR ticket, but they obviously are not current using it. Now the flight instructors who teach here know I test this on the final ride so they have now inserted this training into the core scenarios of the program. I have been seeing much better results, but the question is that without scenarios, would I have ever detected this? Would the instructors ever have built this into the training? The bottom line is this: Transition pilots have an erosion of skills in the use of analog panels because the computer and the integrated technology in the cockpit are doing the thinking for them. Is the answer to build more redundancy into the system to virtually eliminate the possibility that these survival skills will ever be needed or is it to beef up initial and recurrent training to prepare pilots on an ongoing basis to be ready for anything? The answer lies in the middle of the two. When I am sure that survival skills are unnecessary, then I will lower the standards of training, but until then, pilots are responsible for currency to both standards.

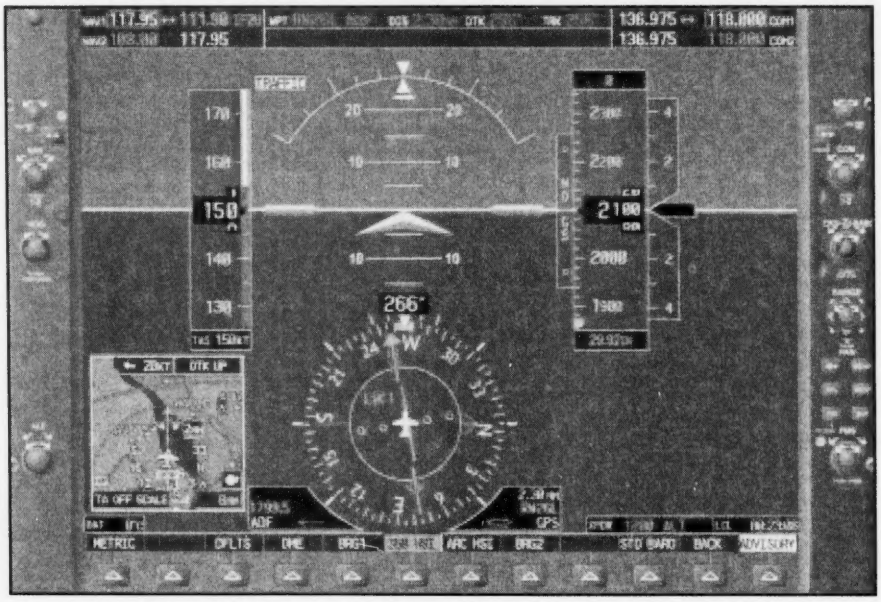
The second pilot group we want to focus on in this article are the pilots trained in the TAA glass cockpit aircraft with no experience in analog aircraft. We are already seeing it. Middle aged professionals coming in laying down the money to learn to fly for a variety of reasons and raising their nose at the prospect of doing it in an aircraft that was built when they were still in high school. They would not rent a car that old, they reason, so why would they rent an aircraft like that? That is great and confirms the reasons we focused on new aircraft as a business premise, but what challenges lie ahead for these students as pilots outside a training environment? Primarily, the aircraft work the same way, so the mechanical aspects of flying remains unchanged. The elements of training that must be addressed are going to be the emergency survival training, the instrument proficiency training, and the operation of the onboard aircraft avionics. These can all easily be addressed with our reengineered Private and Instrument curriculums reinforced with realistic scenarios and a staple of classroom and CBT glass cockpit systems training. The checkride for the Private Pilot can be performed with the same Practical Test Standard (PTS) right now, but this does not do the pilot justice. Should the examiner be requiring more from that applicant? If someone presents an aircraft for a checkride, should they not be tested on any system, autopilot, radio, or emergency concerning that aircraft? What if the examiner has never been trained on that aircraft? Can they safely conduct a checkride on an aircraft they are not intimately familiar with? On multiengine aircraft, the FAA uses a letter of authority (LOA) to designate which aircraft the examiner is qualified to conduct a checkride. There is no such restriction for single engine aircraft. The decision is left to the integrity of the examiner to decide whether they can safely and effectively conduct a checkride in these aircraft; glass panel or not. I am not suggesting that examiners are not qualified to give checkrides in TAA glass cockpit aircraft unless they have some special designation, as many of these qualified individuals have thousands of hours flying airline transport equipment for as many years as I have been flying. Only they can make that decision using their own criteria and the FAA will make those LOA decisions in due time. What I am suggesting is that examiners should raise the bar when an applicant presents a TAA glass cockpit aircraft for a checkride. In order to safely operate the aircraft as a fully certificated pilot, they are responsible for far more systems and emergency knowledge than for a conventional analog aircraft with a simple electrical system. As we speak, there are groups working on revising the standards to incorporate scenario-based techniques into the testing sequence. However, we should be able to make many of these changes without changing the PTS simply by using the special emphasis areas at the beginning of the PTS itself. For instance, item 4 is collision avoidance, item 9 is

aeronautical decision making, item 10 is checklist usage, and item 11 is other areas deemed appropriate to any phase of the practical test. These areas can immediately be used by the examiner to determine an applicant's ability to safely operate the TAA aircraft.

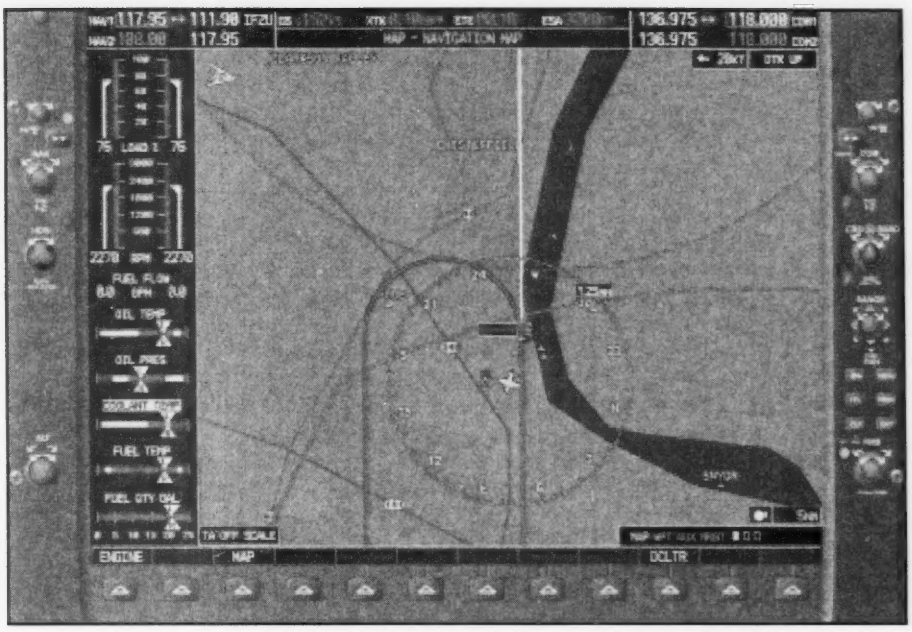
What about the instrument pilot applicant? This is where the jury is still out. An instrument student in a TAA cockpit may never see an ADF or try to interpret and maneuver to a holding pattern at an intersection with one CDI covered up. These are perhaps the most difficult procedures asked of an instrument student in an analog paneled aircraft and this is where we spent a considerable amount of our training time when we were earning our IFR wings. This is where the instrument student really learns the true meaning of situational awareness in IFR conditions. The needles only present a limited view of the world around the aircraft, but it was the only view many of us traditional pilots had, and by gosh, we had to know them in order to earn our IFR ticket. If a TAA instrument student never gets this tough "seat of the pants" training and learns everything from looking at the Multifunction Display (MFD) which does the analytical work for them, are they ever really developing the piloting and survival skills that would qualify them to fly in an analog paneled aircraft, even though the certificate in their pocket says they can?

There is no doubt that a picture is worth a thousand words and this is certainly true on a glass paneled aircraft display. A perfect example is during an instrument approach. Many approaches consist of a downwind, base, and final vector as the controller is trying to get the aircraft sequenced for the final approach fix (FAF) while keeping other aircraft separated and spaced. The MFD displays the aircrafts exact position, with a wind box indicating actual wind speed and direction, the aircraft projected flight path (where the aircraft will be in one minute), and the magenta line which represents the final approach course on the moving map, as well as distance and bearing information to the fix. Now the instructor is sitting there watching the approach unfold and is mentally calculating at what point the controller will issue the next turn toward the FAF. What is the student thinking? In the old days, they were moving their eyes rapidly around the cockpit trying the keep the aircraft flight parameters in check while waiting for the needles to start to move in the correct direction. While the needles were on the pegs, all that a pilot could do was wait until the aircraft approached the hot zone of the instrument when the needles would start to move toward the center. At this point, all the action begins and there is a mental coordination between turning at the same rate as the needle while at the same time trying to calculate and apply appropriate wind drift so as to capture the centered needle exactly at the moment the required wind drift is applied. This is not a skill that is learned by reading a book and it sure won't magically appear as a skill on the resume of one who was not trained for it.

In TAA aircraft, it is different. The pilot uses a different part of their brain as the computer generated images on the screen draw the picture of what is going on and your job is to interpret it and react accordingly with additional inputs to the flight plan or autopilot as needed. The pilot has become a cockpit automation manager. Checklists complete, the pilot has coupled the autopilot to fly the approach and they are watching the action on the MFD as if they were playing a video game. Now this is great and, believe me, it is every bit as satisfying to drive the aircraft to a safe landing, but how ready is the pilot if you take the picture away? If the MFD goes dark or because of an alternator failure the pilot has been forced to turn it off as a load shedding procedure to conserve power for landing because he needs the battery to lower flaps and the landing gear, what is the pilot's next move? It is by the law of primacy to revert to their basic instrument training and use the HSI and the CDI needles to navigate toward the final approach course or holding pattern. What if the pilot was




*The G1000® Primary Flight Display (PFD) offers the pilot communications, navigation, and aircraft flight information was well as pilot selectable options such as the insert map.*




*The versatility of the G1000® Multi-Function Display in the navigation mode increases situational awareness.*

never trained for instrument in a round dial analog aircraft? There may be no foundation for them to fall back to. The picture is gone and now the analytical decision making part of their brain has to kick in and that part may be underdeveloped.

One technique we use during IFR flight scenarios and when testing a students understanding of Electronic Situational Awareness is to ask the student to talk about what the controller might do next. This forces the student to use mental analysis to put together the answer on the fly. They must glance at the trend vector to determine how many minutes or seconds until crossing the final approach course, look on final approach for TIS traffic displays (if available), glance at the HSI or NAV compass rose around the aircraft and come up with an answer like "it looks like in 30 seconds the controller should give us a left turn to heading 320 which will put us at a 30 degree intercept angle to the final approach course just outside the outer marker, but with the current winds, we may be pressed for time over the marker so lets do our checklist now." This is a true educational moment. You can feel it in the aircraft. At this moment, both the instructor pilot and the pilot in training look at each other and smile because the pilot in training now gets it. They have demonstrated both an understanding of the technology and used electronic situational awareness to predict a future sequence of events based upon that technology. It means that the student is ahead of the aircraft, and this is essential for safely operating any aircraft, but especially these TAA aircraft whose speeds are now topping 200 knots in many models.

Be careful. Just because a pilot can do it with a moving map, does not mean that they can do it without, such as would be the case after a MFD or alternator failure. We must not let down our vigilance and assume that since we have systems redundancy built into the aircraft that we will never encounter a problem that requires reversion to an old skill. We must continue to teach all students basic IFR navigation and survival skills in addition to all of the new technology that comes our way. We must continue to create scenarios that will realistically force the student to use the analytical portions of their brains so that they will be ready for that dreaded day when the red warning light comes on. Those same skills will keep them ahead of the aircraft when they finally move from the 120 knot aircraft to a 200 plus knot aircraft.

After teaching our G1000 ground school for the umpteenth time, I am more convinced than ever that it is the training technique we should be all using. I feel confident that we are preparing pilots to handle whatever Murphy can throw at them. After all, isn't that why we have flight training? Eventually your time and opportunity will come to transition to the new technology or maybe you are already involved in a training program in a TAA aircraft as a new pilot in training. I can only urge you to really give FITS training a serious look for your own flight training. It does not cost any more, but it sure is effective and helps you make sense of complex avionics panels, but also may help you understand the picture should you need to "go back."

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# FITS and Scenario Development

by Tom Glista

The FAA/Industry Training Standards (FITS) team has been out putting on Pilot Proficiency Program (WINGS) approved FITS instructor seminars across the country over the past year. One of the most interesting aspects is what instructors think they understand, but don't. During the last three seminars we asked, by a show of hands, who uses scenario-based training? Most instructors raised their hands. But, by the end of the seminar, many of these same instructors were asking us if there is a database of scenarios they can use. What they thought was scenario-based training, really wasn't. This article is about how to develop scenarios to meet lesson (learning) objectives.

But first, why haven't we developed a bank of scenarios? Three reasons: time, money, and specificity. Considering the FITS program was just an idea four years ago we have made great strides working with industry partners, developing curricula, working Technically Advanced Aircraft (TAA) issues, developing lessons learned, partnering with aircraft manufacturers, and training providers, etc. We had to work the big issues first. The second is competing priorities within the FAA. With limited resources we must prioritize our work. Developing a bank of scenarios has not risen in the priority level to fund. Third is specificity. FITS philosophy is one size does NOT fit all. Training should meet the needs of the pilot. There are so many possible permutations it could take years to develop a comprehensive bank of scenarios. It's like the old saying, "How do you want it—good, fast, or cheap? Pick two."

Scenario-based training is a training system that uses a highly structured script of real-world experiences to address flight-evaluation in an operational environment. The key words here are "highly structured" and "real-world." The instructor must structure the scenario to meet the desired training objective of that lesson. A loosely developed scenario is easily brought off track and the training objective may not be reached. And, of course, it has to be real. The intensity principal of learning implies that the student will learn more from the real thing than a substitute. Also, failures must be realistic. An engine failure, in instrument conditions, with severe icing, and a dual screen failure is not realistic.

Consider the following example: The flight instructor provides a detailed explanation on how to control for wind drift. The explanation includes a thorough coverage of heading, speed, angle of bank, altitude, terrain, and wind direction plus velocity. The explanation is followed by a demonstration and repeated practice of a specific flight maneuver, such as turns around a point or S turns across the road, until the maneuver can be consistently accomplished in a safe and effective manner within a specified limit of heading, altitude, and airspeed. At the end of this lesson, the student is only capable of performing the maneuver.

Now, consider a different example. The student is asked to plan for an arrival at a specific uncontrolled airport. The planning should take into consideration the possible wind conditions, arrival paths, airport information and communication procedures, available runways, recommended traffic patterns, courses of action, and preparation for unexpected situations. Upon arrival at the airport the student makes decisions (with guidance and feedback as necessary) to safely enter and fly the traffic pattern. This is followed by a discussion of what was done, why it was done, the consequences, and other possible courses of action and how it applies to other airports. At the end of this lesson the student is capable of explaining safe arrival at any uncontrolled airport in any wind condition.

The first example is one of traditional learning where the focus is on the maneuver. The second is an example of scenario-based learning, where the focus is on real world performance. Many learning developers in flight training have built on the former option. Traditional training methods in many instances are giving way to more realistic and fluid forms of learning. The industry is moving from traditional knowledge-related learning

outcomes to an emphasis on increased internalized learning in which learners are able to assess situations and appropriately react. Knowledge components are becoming an important side effect of a dynamic learning experience.

Reality is the ultimate learning situation and scenario-based training attempts to get as close as possible to this ideal. In simple terms, scenario-based training addresses learning that occurs in a context or situation. It is based on the concept of *situated cognition*, which is the idea that knowledge cannot be known and fully understood independent of its context. In other words, the more realistic the situation is and the more we are counted on to perform, the better we learn. Simply put, train the way you fly, and fly the way you train.

Now think about this. Which pilot has more experience and which one would you trust to fly a loved one to a destination? Pilot number one has 500 hours, but has spent most of the last 400 hours in the local area or doing touch and goes. Pilot number two has 250 hours, but has spent the last 200 hours flying across the country. Although pilot number one has more flight time, pilot number two has more experience. Scenario-based training more quickly develops the student's experience. Students are exposed to more situations in a shorter amount of time than the traditionally trained pilot.

Now let's construct a couple of scenarios. This first scenario is for a student pilot training for a private pilot certificate. The lesson objectives are to develop proficiency in ground reference maneuvers, stalls, and slow flight. The day before you call or e-mail your student that the scenario will be that you are a news photographer who is doing a story on a nearby town that was flooded the day before. (Use your imagination, the camera crew is heading to an accident site, doing beach reports, pipeline patrol, taking photo of wild life, fish/animal counting—anything that would realistically require flight around 1,000' AGL.) Your student arrives for the flight with a flight plan. The flight plan should include performance planning, a risk assessment, fuel requirements, weight and balance, etc. During the flight, you pick out objects that need to be photographed that would require circling around the object (turns around a point, s-turns, and eights), and flying along property lines (rectangular course). You, as the photographer (and yes, bring a camera), can apply situations that would require aeronautical decision making and risk management by the student. You tell your student that you cannot get the shot you absolutely must have unless you fly lower (below safe minimums). Put pressure on the student, if you don't go lower, you will complain to the pilot's boss and will not pay for the flight. After that portion of the flight, on the way home, you can climb to altitude and practice the flight maneuvers. There are some things that must be done in a non scenario environment for safety sake. Do not do accelerated stalls on base to final. But good ground school training with "what if" scenarios can help explain why we practice certain maneuvers.

Another flight scenario. Your student is working on an instrument rating. The lesson objectives are GPS and VOR navigation, non-precision approaches, and equipment failure. Again, the day before the flight you call or e-mail your student the mission. The student needs to pick up his/her mother at airport AXX and fly to airport BXX for his/her sister's wedding. The student again arrives with a plan that includes performance planning, a risk assessment, fuel requirement, weight and balance, etc. As an instructor you may need to provide fictitious weather for this scenario. En route the instructor can play controller and/or Flight Watch bringing the weather down to a point where a decision needs to be made whether to divert. If they do divert, what about Mom? What about the wedding? They are depending on the transportation. Did the student prepare alternate plans? Other realistic situations can be thrown in. For example, loss of RAIM (Receiver Autonomous Integrity Monitoring), the wind favored runway is closed, PFD or vacuum system failure, flying a DME (Distance Measuring Equipment) arc, holding, etc. The student not only meets the objectives of the flight, but the student is also demonstrating and developing risk management and aeronautical decision making skills. The student will also demonstrate single pilot resource management with the appropriate use of automation by getting weather en route (either through air traffic control/Flight Watch or data link on the Primary Flight Display or PFD), prioritizing tasks, etc.

Appropriate scenarios are dependent on aircraft type, aircraft systems (complex, high performance, glass cockpit, etc.), where the student is in the training process (private pilot not yet soloed or a CFI preparing for the practical test), environment (mountainous terrain or flat lands), or what type of flight it is (e.g. flight review, instrument proficiency flight), and what is the objective of the lesson. The possible combinations and, therefore, possible scenarios are almost endless. For ideas on scenarios look at 14 CFR sections 119.1(d) and (e). It describes both commercial and non-commercial operations. For ground reference maneuvers there are banner towing, aerial photography or survey, pipe line patrol, and sight seeing flights. For high performance maneuvers, you can consider aerial applications. For short and soft field takeoffs and landings, cross wind operations, operations in different classes of airspace, IFR operations (including approaches), or cross country scenarios, you might think about delivery of human organs for transplants, package delivery, or taking the boss to a meeting. Flight schools should develop banks of scenarios to meet the needs of their clients.

Of course, scenarios alone do not make FITS training. I will discuss another FITS tenet in my next article. Fly safe.

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# All That's Old is New Again

Gnome-powered Bleriot Model XXVII racer taken at RAF Hendon.

## *Tracing the origins of the Technically Advanced Aircraft*

story and photo by Michael W. Brown

As a visitor to most any small airport will attest, the term "technically advanced" hardly describes the equipment flown by most general aviation (GA) pilots. Until recently, the GA manufacturing industry rested in a comfortable state of equilibrium—neither benefiting from, nor inspiring any new, technological growth. So it had been for nearly three generations. Not surprisingly, this had a profound impact on how pilots operated, and in particular, how they trained. Because instructional and examining techniques have changed so little since the dawn of regulated aviation, the industry now finds itself taking an unusually introspective look at doctrine once considered sacred. And for the flight training industry, it took but a single event to overcome more than 70 years of regulatory inertia—the emergence of the modern technically advance aircraft (TAA). In short, had it not been for some rather stunning advances in aircraft design; the status quo might well have endured another decade. However, as the first century of powered, heavier than air flight drew to a close, so too did this period of operational and technical stagnation.

### What's Technically Advanced Now?

The dawn of the 21st century brought with it considerable advances in cockpit technologies, particularly in the high-end GA market. Sophisticated global positioning system, or GPS, receivers boasting moving map displays were now being married to equally impressive multi-function displays (MFD). When coupled with an integrated autopilot, this provided the weekend (and professional) aviator with a formidable suite of tools to manage his or her flight. More recently Cirrus Design, builders of the ultra-slick SR22, further defined the state of the art with the introduction of its first Avidyne Entegra-equipped production aircraft. Gone were the familiar round-dial "steam" gauges of yes-

teryear, their tasks now performed by a single primary flight display (PFD).

As you would expect, other manufacturers were quick to take notice. Industry heavyweights like Diamond, Cessna, New Piper, Beechcraft, and Mooney all introduced glass-paneled aircraft into their line-up. While the migration from round dials to PFDs and MFDs has been rapid and nearly complete, it has not been without its challenges. This technological leap has forced manufacturers, flight schools, and regulators alike to take a critical look at how pilots were being trained. The fear was that our decades old training model was simply inadequate in meeting the challenges faced by the 21st century aviator.

In an effort to help pilots exploit the advantages of these new cockpit systems, the Federal Aviation Administration (FAA) and industry have given considerable thought to modernizing current training methods. One of the more fruitful undertakings involved the FAA and stakeholder community in a collaborative program known as FITS, or FAA/Industry Training Standards. Central to this program's success was the determination of scope. The focus would be placed squarely on what would henceforth be known as Technically Advanced Aircraft or TAA. The challenge laid not only in teaching the "knobology" of these new avionics, but also the skills needed to leverage their enhanced capabilities in an increasingly complex airspace system. In short, decades of accepted training practices were now undergoing an unprecedented level of scrutiny.

To this end, initiatives such as FITS have done much to define the modern training paradigm. While this is a significant step in the right direction, it's worth noting that history also has much to teach instructors and regulators alike regarding technology, and more specifically, its application and impact on flight training. With that in mind, a philosophical and historical overview is in order.

## The Nature of Technology

When applying the term "technically advanced," we normally do so because the mechanism being discussed is, in some manner or fashion, more capable than its predecessor. It then follows that anything technically advanced should be embraced with great enthusiasm—right? Well, not always. Case in point; how many times have you heard the old sage at any airport U.S.A. lament over GPS and its negative impact on airmanship? He or she speaks of the eroding pilotage and dead reckoning skills so essential in modern aviation. "People just follow the magenta line," experts grouse. Of course, this begs the question, "Did the grizzled veteran instructors of the 1940's complain that improved engine reliability had sapped the pilot community of its ability to cope with power plant failures and off-field landings?"

The point is that you train to meet your operational need, and technology is a major consideration. If you fly a vintage aircraft propelled by a cantankerous engine, you had better understand something about terrain/route planning, power-off spot landings, the forward slip, and aircraft glide performance. If you are flying a *Cub* with no electrical system, you had better be able to draw a course line, read a sectional, and pick out landmarks. Now to be clear, these are all important skills worthy of any modern training regimen. However, the emphasis they receive during initial, and most certainly recurrent training, is often diminished. For many, the need for such skills has been augmented by new disciplines, such as automation management. But regardless of what you fly, your safety depends greatly on your mastery of the aircraft. This we can clearly connect to the need for effective training.

Moving forward, all of this raises some interesting points regarding technology. First, as with most any technological advancement, the GPS addressed one issue while creating another. Next, technology demands something of those who use it, if it is to be utilized to its maximum potential. In aviation, this almost always raises the issue of proper training. Finally, technology is evolutionary in nature—rarely (if ever) revolutionary. What was the last invention that did not owe its existence to technologies that came before? Early gliders evolved from kites; early airplanes evolved, in part, from both. The internal combustion engine evolved from the steam engine, whose earliest models inspired the jet engine. You get the idea.

I mention this because the evolutionary nature of technical advancement affords us the time needed to adapt, but only if we are vigilant and seize the opportunity. As the last few years have taught us, the faster the evolutionary process, the more quickly we must adjust our course. Fortunately, aviation history has provided more than one model for assimilating new technologies. While today's glass-paneled aircraft are the benchmark for what's technically advanced in the 21st century, have you stopped to question what history would consider the first TAA?

## The First Technically Advanced Aircraft

Although any number of definitions could be used to highlight the characteristics of a TAA, an appropriate (if not timeless) definition might be "*any aircraft that differ so greatly from their predecessors as to profoundly change the way pilots fly and train.*" So by definition, what we consider to be technically advanced today will be commonplace a decade from now. Equipment that was once advanced is now obsolete—replaced by more capable successors. With that in mind, I offer my candidate for the first technically advanced aircraft.

The aforementioned discussion of aero engines may give a clue. One could argue that the first technically advanced aircraft could have been considered so not by the virtue of their avionics (indeed there were none), but rather by their method of propulsion. In 1908, a technically advanced aircraft may well have been one equipped with a state-of-the-art Gnome rotary engine. But what makes a power plant of this vintage advanced?

During a period when the internal combustion engine was cumbersome, unreliable, and lacking in power, the Gnome rotary engine stood alone as one of the great technical achievements of its day. Lightweight, powerful, and reliable, the Gnome propelled many famous European marques, including those built by Farman, Bleriot, and the Shorts Brothers. The Gnome not only dominated pre-World War I aviation (at least in Europe), but profoundly changed what it meant to be an aviator during this important point in history. To illustrate this, consider the state of aeronautics during this period. In 1906, the Wright Brothers had a virtual monopoly on the aviation record books. At just over 24 miles, they recorded the longest airplane flight to that point, and had soared as high as 50 feet. Still, given they were the only aviators flying what could be called a practical, controllable airplane, these numbers were indeed impressive. However, just three short years later, these and other records had all been eclipsed. Henry Farman established the mark for the greatest distance flown at over 145 miles; and he did so while piloting a Gnome-powered aircraft of his own design. The endurance record, again made possible by Gnome reliability, was an extremely impressive four hours and 53 minutes. The following year, the distance record would be more than doubled, as Maurice Tabuteau piloted another Farman creation over 363 miles. An additional record, this one for altitude, would be obtained by yet another Gnome-powered machine. This time, a *Bleriot* would set the mark at over 10,100 feet.

With the ability to fly farther and faster came the need to acquire a litany of new skills. Pilots now needed to understand weather, navigation, and performance planning to a degree never before required. Just imagine how much different a quality training program would have looked in 1910 when compared to 1906. Consider the skills you needed to master before departing on your first cross country flight. And we thought keeping up with the GPS was difficult.

## The Next TAA

As time went on, and the ability to fly farther, higher, and faster became more commonplace, pilots increasingly found themselves encountering adverse weather conditions. Given the relatively primitive state of aircraft technology, and a corresponding lack of knowledge regarding flight in such an environment, the outcome was often tragic, but inevitable. This would all change, however, as gyroscopically-driven instrumentation was matched with the first airborne radio receivers. Some two decades after the Gnome defined the first technically advanced aircraft, the second generation of TAA would emerge, bringing with it the promise of "blind" flight.

Now we are all familiar with the daring exploits of wartime hero and aviation pioneer Jimmy Doolittle. On September 24, 1929, then Lieutenant James H. Doolittle became the first pilot to take off, fly a set course, and land guided only by his on-board radios and instrumentation. Doolittle received directional guidance from a radio range course aligned with the airport runway. Not unlike today, distance information relative to the runway was provided by a series of radio marker beacons. In addition to his radios, Doolittle relied on a barometric altimeter, directional gyro, and an artificial horizon to maintain aircraft control. During this flight, Doolittle sat in a hooded cockpit, but was accompanied by a check pilot who stood ready to intervene in case of an emergency. On May 9, 1932, Capt. A. F. Hegenberger duplicated the feat, this time without the safety pilot, thereby making the first blind solo flight using only on-board radios and instrumentation.

In the years interceding these events, a groundbreaking booklet emerged that would prove as influential as any ever developed for the flight training community. Written by Howard Stark in 1931, the treatise *Blind or Instrument Flying* codified doctrine that would serve as the basis for instrument flying from that day forward. Although only 30 pages in length, Stark discusses the aero medical issues associated with instrument flight, weather forecasting, and, most significantly, establishes the needle-ball-airspeed approach to instrument flying. He even discusses how to properly use these instruments to recover from inadvertent spins.

Just three short years later, Stark published a more highly refined version of his pioneering work. In it, he would build upon his earlier writings by discussing the intricacies of aircraft instrumentation, as well as introducing the methods used for flying early instrument approaches. Considerable attention was also given to the instructional techniques used to teach instrument pilots. This foundation was critical, because less than a year later, the Department of Commerce would publish a rule establishing the new scheduled air transport pilot rating. For the first time, pilots engaged in passenger carrying flights for hire would be required to demonstrate instrument competency. In 1936, the instrument rating as we now know it became a reality. In less than a decade, aviation advanced from open cockpit flight through the clouds with no formalized operating practices, to a reasonably safe and effective transport system. None of this would have been possible without the marriage of technology and training.

This discussion of training is poignant, because unlike the Gnome-powered TAAs of the early 20th Century, this technological advance not only changed the way pilots trained, but also the manner in which they were certificated. In this case, regulatory changes resulted not from the technology itself, but rather by the environment in which it allowed pilots to operate. Moreover, unlike the previous Gnome example, this TAA would rely upon technologies outside the aircraft to perform it functions. In effect, these were the first systems to inexorably link the pilot and aircraft with a ground-based infrastructure. It would also serve as the catalyst for the communication, navigation, and surveillance mechanisms that now comprise our modern air traffic control system.

## A Commentary on the History of TAA

All of this leads us to today. Sure there have been advances over the past 75 years. Fabric has given way to metal, and tail wheels are all but extinct on most airport ramps. Deicing, turbo-charging, pressurization, and the introduction of single-pilot turbo props and jets within the GA community have all increased technical diversity. However, it wasn't until the arrival of the modern technically advanced aircraft that the GA community once again experienced a profound change that impacted pilots on a large scale.

But how do we compare the impact of today's avionics-based TAA with advances from the past? Unlike the Gnome engine and the Sperry gyro, this new generation of TAA offers no substantive increase in operational capability, at least not by regulation. For example, a Garmin G1000-equipped *Skyhawk* cannot fly more approaches to lower minima than the C-172 "Classic" in which many of us learned — assuming the "Classic" in question is equipped with an appropriate GPS receiver. Moreover, until augmentation-enabled instrument procedures become the norm, these systems do not provide greater access to more airspace or increased en route and approach capabilities. They certainly do not allow pilots to fly higher, farther, or faster. So if you consider only these factors, you might quickly conclude that today's TAA had far less impact than any of its predecessors.

Of course that assessment does modern technology a considerable disservice and ignores its many worthwhile attributes. For one thing, today's TAA was designed to increase safety by improving situational awareness and cockpit resource management. To this end, modern avionics excel, but only in the hands of a properly trained pilot. The improved situational awareness provided by today's avionics certainly afford a greater level of safety, which tends to broaden the pilot's individual operating envelope. Safety is further enhanced by the introduction of data-link systems that bring the latest weather information directly into the cockpit. Terrain avoidance information is also available via these new glass systems. In fact, these same systems, in conjunction with technologies such as Automatic Dependent Surveillance Broadcast (ADS-B), may one day make self separation in the national airspace system (NAS) commonplace. Just as the PFD may one day render the round gauge obsolete, the PFD/MFD may one day have a similar impact on the air traffic control system it inspired. Of course no matter how differently tomorrow's NAS may look and function, technology and training will most certainly remain indivisible.

## What Does it All Mean?

We've clearly come a long way since the first technically advanced aircraft took flight all those many years ago. The bonfires and lighted airway beacons that once guided pilots on long flights have been replaced by celestial-based navigation. These long flights have grown even longer, thanks to sophisticated and reliable engines that routinely carry us to our destinations. Some of the advancements discussed herein required changes in pilot certification rules. Others did not. Most provided greater access to airspace by virtue of speed, range, or reliability. All drove significant improvements in flight training. But of what benefit is this history lesson as we look at how best to train modern aviators?

We are all familiar with the old adage that says necessity is the mother of invention. That was true in the case of language, the wheel, and countless other human achievements. We now know this paradigm works in reverse, which is to say that in aviation, invention is very often the mother of necessity. New technologies bring with them new capabilities. Eventually, these capabilities shape the very environment in which they operate until finally, they are integral to their surroundings. When this occurs, not only does the technology become a necessity, but so too does the training needed to use it.

One final observation. Because technology is a natural catalyst for change, it is often the case that existing problems or shortcomings are credited to the technical advances that expose them. Nowhere is this more evident than in aircraft with sophisticated cockpit systems. For example, the emergence of modern technically advanced aircraft led to the creation of FITS. In turn, FITS sought to address issues such as aeronautical decision making, risk management, situational awareness, and single pilot resource management. Clearly, these disciplines are as critical to the pilot of a 1946 Piper *Cub* as they are to the Cirrus SR22 pilot undertaking an instrument flight rules (IFR) cross-country. Yet it took the emergence of these new avionics to focus our attention toward disciplines we had long since taken for granted. The need to do this came, in no small part, from the arrival of the modern TAA and the capabilities it provided. So in that way, technological change continues to prove beneficial, if for no other reason than it continually forces a critical review of how we do business.

And for many of us, that business is flight training. Whether you're talking about 1906 or 2006, good training starts by teaching how to look at the mission, then at the hazards and risks posed by that mission, and finally at the tools needed to mitigate those risks. In terms of the latter, be mindful that technology is but a single element—no more or less important than proper performance planning, medical fitness, or pilot currency. In other words, no matter what advances may come, the fundamental skills needed to be a safe pilot are timeless—even if the technology being used isn't.

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# So What's All This about VLJs?

by Mary Pat Baxter

They're definitely coming.... the Cessna *Mustang*, Eclipse 500™, Embraer *Phenom*, ATG Javelin, and Diamond *D-Jet*. Cirrus is developing a "personal jet" and Piper has one in the works too. Take a look at some of the manufacturer's Web sites, these are some pretty impressive and no doubt fun to fly aircraft.

**What is a VLJ?**

A VLJ is a Very Light Jet, generally under 10,000 lbs., with four to six seats (including pilot seats), speeds of about 300+ knots, capable of flying at altitudes of up to 41,000 feet.

**Don't you have a better definition than that?**

We hesitate to define these aircraft specifically and slap a label to that definition. This segment of aviation is so new and has already changed so much with ever smaller entrants in the arena that any definition would probably quickly become obsolete. In the past we've categorized aircraft by their size, weight, or number of seats. It's becoming increasingly clear that perhaps size doesn't matter and maybe the operating environment would be a better means for grouping aircraft. It's something we would consider if we start making rule changes in this area.

**What role is the FAA playing in the development of VLJs?**

Many lines of business within the FAA, such as Certification, Flight Standards, Air Traffic, and General Counsel are affected by this exciting new aspect of aviation. In June of 2005 we established a cross organizational group to make sure we define and address all potential issues and coordinate our efforts where needed. We broke the group into committees to address specific areas such as pilot training, inspector training, maintenance, air traffic, etc. The whole group of about 30 representatives meets about once every six weeks so we can share what we're doing and coordinate our efforts where areas overlap. We usually meet by telcon since we're scattered across the country.

**Can VLJs really be operated by a single pilot?**

The manufacturers are designing these aircraft to be certificated for single pilot operation. As of the date this article is being written, no VLJs have received final certification, but Eclipse and Cessna expect to achieve it this year. There may be an initial second-in-command requirement, a "pilot mentor" requirement, or other requirements mandated by the manufacturer or insurance companies depending on the pilot's experience level.

The FAA will be conducting the Flight Standardization Board (FSB) for the Eclipse™ in mid-June. This is basically where a group of FAA inspectors, led by a Chairman from the Aircraft Evaluation Group, goes through the training for the aircraft, takes type rating tests, and makes any recommendations as far as training or pilot certification requirements. So that's the step in the certification process where pilot requirements are finalized. (See the Tales from an FAA Inspector in the May/June 2006 issue for more information on FSBs.)

**Is the FAA going to require specific pilot training?**

As noted above, final requirements for training will be determined during the FSB. However, here's what we're expecting:

Training will be done under the FAA Industry Training Standards (FITS) concept. We are working with industry as they develop scenario-based training programs for acceptance under FITS. Go to <http://faa.gov/education_research/training/fits/> for more information on FITS. Manufacturers may also specify in the limitations section of their airplane flight manual that certain training be accomplished in order to act as pilot-in-command of the aircraft.

Because the VLJs are turbojet-powered aircraft, a type rating is required and pilots will be tested in accordance with the *Airline Transport Pilot* (ATP) and *Type Rating Practical Test Standards* (PTS). The FAA is in the process of beefing up these PTS to include more aeronautical decision making (ADM), single pilot resource management (SRM), and a greater emphasis on performance analysis and scenario-based testing.

**What about the National Air Space? Are these aircraft going to "blacken the sky" and clog up the system?**

Not likely, especially in the near term. First of all, these aircraft are designed to utilize smaller runways with takeoff and landing distances in the 2,000-5,000 foot range. It's expected that they'll be utilizing the regional airports and not adding to the already congested hub airports. Initially it's expected that there may be 100 VLJs by 2006, then perhaps about 500/year within several years of introduction.

However, estimates range from 5,000 units by 2020 to 15,000 units by 2020, so that's a pretty hefty increase. Through the Next Generation Air Transportation System (NGATS), the FAA has already begun to prepare

for this longer term increase and potential capacity issues not only from the VLJs, but all aspects of air traffic. You can read more about NGATS at <http://www.jpdo.aero/site_content/NGATS_v1_1204.pdf>.

**Well, what about mixing with faster airplanes, both at altitude and in terminal areas?**

While some of these aircraft are certified to operate at 41,000 feet, it is expected that because of their range (about 1,100 plus nm) they'll be utilizing the mid-altitudes of about 20,000 to 25,000 feet. Pilot training and testing will emphasize operations in complex airspace and with much faster aircraft to mitigate any problems in this area. Through the work of our cross organizational group, all aspects of Air Traffic (enroute, terminal, systems operations, tactical operations, training, etc.) are very much in tune with the capabilities and limitations of the aircraft and will be very well prepared for their entrance into the system.

**Will all VLJs have glass cockpits?**

So far, that's what it looks like.

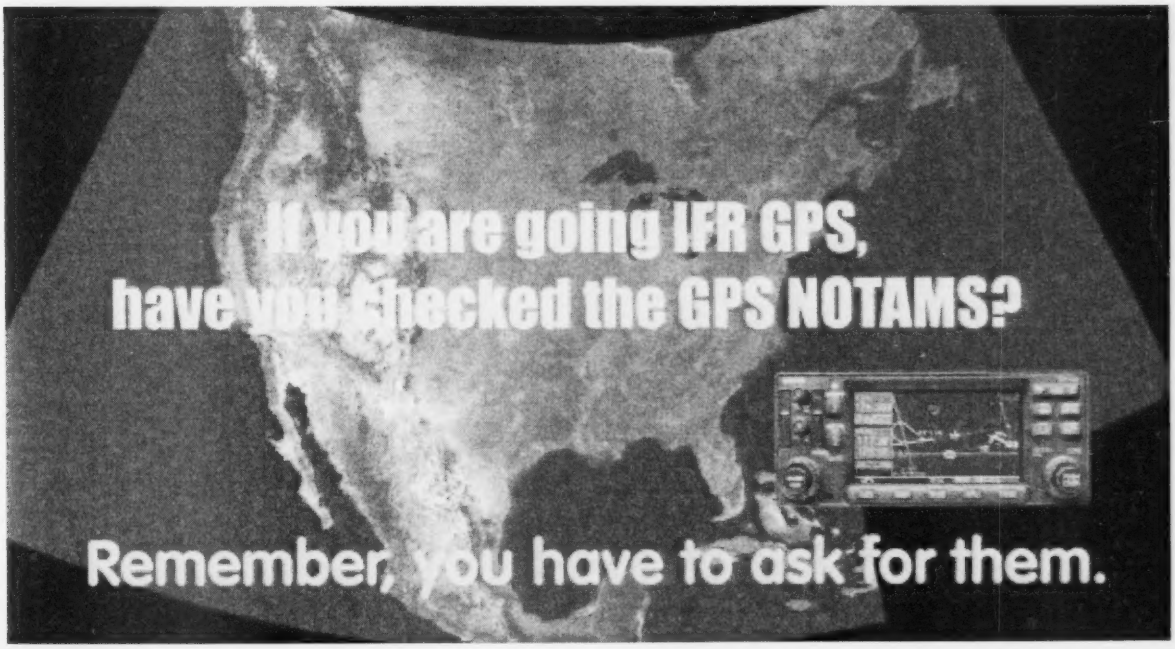
*(Eclipse photo)*

The Eclipse even takes this a step further, integrating many aircraft systems into the Avio system they are designing into their aircraft.

**So will the average GA pilot be able to fly a VLJ?**

Price ranges are from about $1.4 million to about $2.7 million, so they're really not much more expensive, and in some cases less expensive, than some of the light twins or small turboprops. So...if it's in your budget and you've got the discipline to successfully complete the rigorous training program and pass the type rating check, you too can pilot a VLJ!

*Mary Pat Baxter is an Aviation Safety Inspector in Flight Standards Service's General Aviation and Commercial Division and the Program Manager for VLJs.*



# GPS: We're Hooked!

by Michael Lenz

It all started innocently enough... somebody realized a LORAN receiver from a boat would work in the air. It was the 90's and things were changing fast. Everyone was looking forward to the next new innovation in navigation, the same way that coffee drinkers look forward to that first cup in the morning. Then came something called GPS and it all seemed too good to be true.

First hand-helds appeared—heavy and bulky. Once again many were from marine applications. Then the real aviation panel mounts showed-up on the scene. It was hard to "Just Say No." Everybody was doing it and it looked like GPS had become the navigation means of choice. At first they were just novelties rather than our "real" means of navigation." With "Direct-to" capability and a database full of useful information like the "nearest airport" and frequencies for Air Traffic Control (ATC) and Automated Flight Service Station (AFSS), we quickly forgot about the venerable VORs, NDB's and DMEs that had faithfully served us for so many years.

Some pilots couldn't get enough. We've all seen them...the ones who have a panel-mounted unit and a hand-held GPS receiver. That way, if one quit, they wouldn't won't have to kick the habit and go back to VORs.

Sun 'n Fun® and EAA's AirVenture® became the Woodstock's of what was new in GPS innovation. Next thing we knew there were even IFR-approach certified GPS receivers. Now we had the monkey on our backs. It was next to impossible to quit the GPS habit. Few even tried.

Let's face it. We're all GPS shooked! That's not a bad thing. What we're really hooked on is the area navigation or RNAV capability when using GPS.

Now this does come at a cost — and it was captured early and amazingly well by an airline pilot who was flying his personal Cessna 180 while using a new handheld GPS. The reporter had 15,000 hours total time and held an ATP certificate. This pilot submitted an *Aviation Safety Reporting System* (ASRS) report. I don't know who this gentleman is because ASRS reports are anonymous. Whoever he is, if he is reading this and would contact me, I'll buy him lunch at the FAA Headquarters cafeteria. (Don't all call at once!) I would be honored to sit down with such a clairvoyant and prophetic individual. Anyway, here's what he said in July of 1997:

> *I am a 30 year airline pilot flying in a light civil aircraft. The en route wx began to deteriorate and I had to make a 180 degree turn to stay VFR. I was lucky—I found a hole and climbed on top. During the climb, I lost part of my NAV. My new GPS gave me good position info while I worked my way around the wx. I like the use of the battery powered backup to assist in the NAV effort.*
>
> *The reporter also stated he only sent in the report because he was so impressed with the safety aspect of the GPS with pen light batteries being able to help him out of a situation which could have become a problem. He is quite impressed with the GPS unit and operation. His major concern is that it is so good and so reliable that it may lead people into situations where they should not be. He feels every flight instructor should indicate this factor in big red letters to all students: They cannot rely solely on the "magic."*

With the aviation community hooked on GPS for more than a decade now, it may surprise you to learn that GPS NOTAMs must be specifically requested from either AFSS (via phone) or DUATs. This is because the NOTAMs, other than GPS, effective for your route of flight are located and displayed automatically. GPS NOTAMs cover such a wide area that they are not listed by a specific location and must be specifically requested.

Here's another ASRS report from August of 1996 that demonstrates the importance of always requesting GPS NOTAMs. This pilot laments the need to ask for GPS NOTAMs. The aircraft was a Cessna 172.

> *Day VFR flight from Wilmington to Avery County Airport Spruce Pine, NC. Filed VFR flight plan and closed in Hickory, NC. We landed Hickory, NC, and called Avery County Airport for wx into Avery County. Report was minimum haze, good visibility. We departed Hickory with about one hour 45 minutes fuel. We were unable to find the Avery County Airport because of poor visibility. Our GPS told us we were over Avery Airport, but could not see it. New Bern flight watch did not tell us about a NOTAM that all gps systems were inaccurate due to the missile attack on Iraq.*
>
> *About 30-40 minutess later we landed at the Banner Elk Airport in hopes of taking on fuel, but none was available. We again departed with directions to Avery County Airport. We were not able to locate Avery County after repeated calls to Charlotte Approach. We were told when passing Charlotte's airspace that the radar was out for maintenance below 10,000*

*feet for five hours, so we could not get vectors to Avery County as planned. With about 40 minutes of fuel remaining, we were still unable to find airport. I then decided to remain in a valley with good visibility over a golf course. The remaining fuel could and would not get us back over the mountains to safety. Our situation was getting desperate. After getting calls and help from local pilots to get us out, but with visibility getting worse, we decided if we ran out of fuel this would be the best option. Our fuel ran out. I set for a landing on the golf course, but several golfers were playing, so I decided to land on a highway. A safe landing was made with no injury to people on ground or to crew. Very little damage to airplane.*

*What would I do different next time? Refuel in Hickory before going further and receive several hours of mountain flying from a CFI in that area. I would also receive a more detailed wx report from Avery County Airport from a qualified pilot. Had I known the haze was as bad as it was I would have parked the plane and rented a car for the remaining trip.*

Callback conversation with reporter revealed the following info: reporter states that his passenger pilot had done all the work obtaining the briefing and planning the flight. He did not request NOTAMs and was not given any. Reporter feels something as important as a GPS change should be part of the normal briefing and one should not have to request it.

GPS NOTAMs are an easy thing to forget during a preflight briefing. This may be because GPS is almost always available. We've become spoiled. By asking for GPS NOTAMs you could save yourself an unpleasant surprise.

Here's a GPS NOTAM issued recently. Note the very large area that could be affected.

**GPS 04/009 ZDC GPS IS UNRELIABLE AND MAY BE UNAVAILABLE WITHIN A 275 NM RADIUS OF 2958N/0791500W AT FL400. DECREASING IN AREA WITH A DECREASE IN ALTITUDE TO 229 NM RADIUS AT FL250, 163 NMR RADIUS AT FL100, AND 120 NM RADIUS AT 4000 FT AGL. THE TEST AREA IMPACTS THE WASHINGTON, JACKSONVILLE AND MIAMI ARTCC AIRSPACE. WEF 0604201800-0604202100**

Give some thought to a back-up plan if your GPS receiver fails. A simple thing like the batteries going dead can contribute to an accident like this.

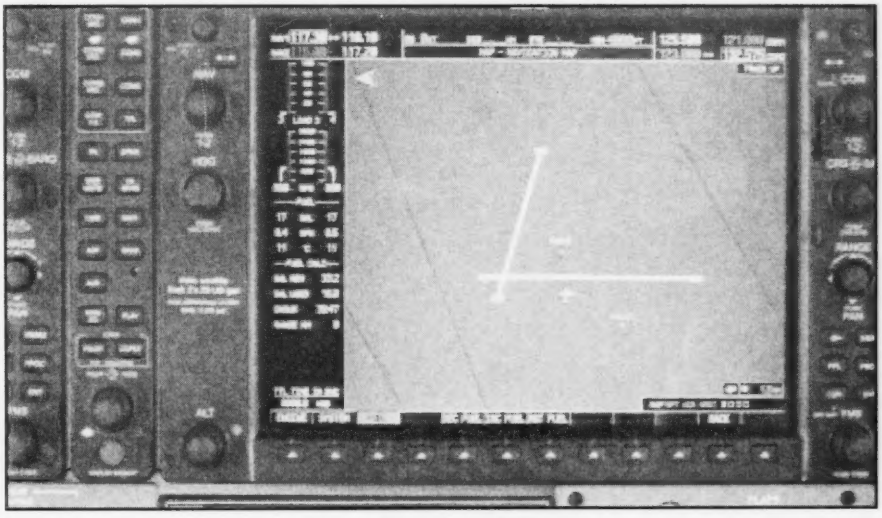
*About 1830 central standard time, a Bellanca 14-13, crashed in a parking lot of a casino near Tunica, Mississippi, while on a personal flight. Visual meteorological conditions prevailed at the time and no flight plan was filed. The airplane was substantially damaged and the pilot, the sole occupant, was not injured. The flight originated from the Moore-Murrell Airport, Morristown, Tennessee, about 1430.*

*The pilot stated that he had flown this trip several times and he did not on this flight perform fuel consumption calculations. He also stated that he was navigating using a global positioning system (GPS) unit and about 10 minutes before arrival at his planned destination airport, the batteries in the GPS unit failed. He continued the flight looking for the airport and stated that he delayed obtaining assistance from air traffic control and did not attempt to use the VOR navigation system in his airplane to determine his position. He located a place to perform a forced landing due to fuel exhaustion and after touchdown during the landing roll, the airplane collided with trees then came to rest.*

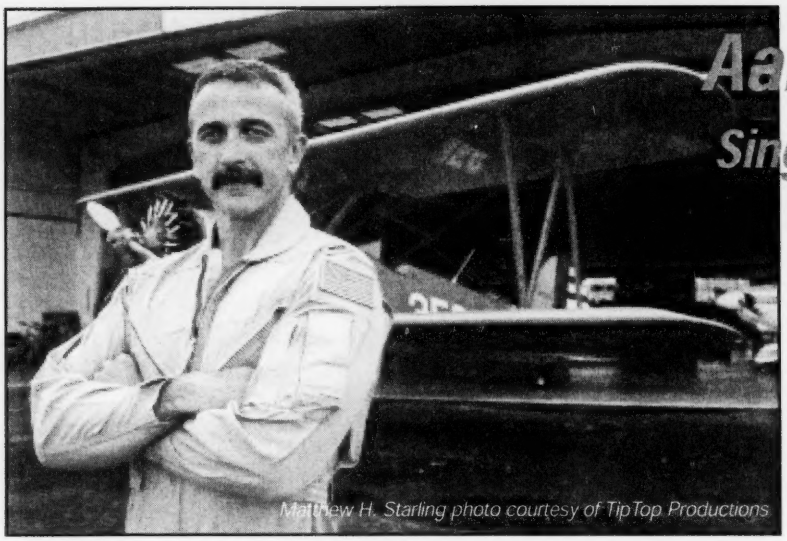
Go ahead and keep your GPS habit — but cover your bases by requesting GPS NOTAM's to make sure GPS will be available. Then, have a backup plan in case of an aircraft GPS or handheld GPS hardware failure. Be ready for the time when you have to quit "cold turkey."

+

*Michael Lenz is a Program Analyst in Flight Standards Service's General Aviation and Commercial Division.*



*The Garmin G1000® Multi-Function Display can display runway information as part of its navigation displays. Airport frequencies, layout, and other data are readily available.*



Matthew H. Starling photo courtesy of TipTop Productions

# Aaron Tippin — Singer, Pilot, and A&P

by Phil Randall

While most people know of Aaron Tippin as a great singer, a few know him as a pilot, and even less know him as an Airframe/Powerplant mechanic. Why would someone with a very successful career in country music want to be a pilot and an A&P? The answer is simple. Aaron once told me that he sings to support his love of flying, but where did this love come from?

Aaron cites his late father as his biggest hero—a statement many of us can make. But last fall, when I presented his father the FAA's Master Pilot Award, the look on Aaron's face confirmed to me, and all of those in attendance, that Willis "Tip" Tippin was a hero to Aaron and anyone who truly loves aviation. Aaron has told me on several occasions that night was very special to his family. A love for aviation runs in the Tippin family. It was Tip who introduced Aaron to aviation, just as Aaron in turn, is sharing his love of aviation with his own sons.

Almost 60 years ago, Tip Tippin began his aviation career as a fighter pilot in World War II. After stints as a flight instructor in the U.S. Navy and the U.S. Air Force, he retired and continued as a civilian pilot and logged over 26,000 hours. Tip was the first Master Pilot Award recipient in North Carolina. Sadly, Tip was killed in an automobile accident on his birthday this past April.

Aaron has another hero in his family, his Uncle Billy. The Nashville Flight Standards District Office (FSDO) presented Uncle Billy with the FAA's Charles E. Taylor "Master Mechanic" Award several years ago for over 50 years in the aviation maintenance industry. Uncle Billy is still active as an aviation maintenance technician (AMT) maintaining Aaron's many aircraft. I believe that Tip and Uncle Billy may be the first brothers to be presented with these prestigious awards.

As for Aaron, anyone who is lucky enough to be around him very long will see that he truly loves aviation and is a devoted pilot and AMT. He and Uncle Billy maintain the many aircraft he has acquired and are meticulous in the upkeep of each and every one of them. Aaron's first airplane ride was at age three and during high school he began hanging out at the airport with his Dad. Learning to fly and working on airplanes, his career was pretty much set in stone that he would become a professional pilot like his Dad. Aaron soloed at 16 and by 19 had earned his Commercial Certificate and his Multi-Engine and Instrument ratings. He began flying as a freelance and corporate pilot on his way to becoming a major airline pilot. But the fuel shortage hit in the 80s and the major carriers started furloughing pilots. That is when he decided to pursue a career in the music business in earnest. The dedication paid off. Charley Pride, David Ball, The Kingsmen, The Mid-South Boys, Mark Collie, and others began to record his songs.

How was I lucky enough to become friends with this man? Several years ago, while visiting a mutual friend, Jennifer Baker, owner of Baker's School of Aeronautics in Nashville, I noticed a life-size cutout of Aaron in her office. I asked her, "What's he doing, learning to fly?" She replied, "No, he has been flying forever. He's getting his Airframe and Powerplant Certificates." My first words were, "Wow, wonder if I could get him to write and sing a song about Charlie Taylor and all AMTs?" He still owes me that one!

Several weeks later Jennifer set up a meeting with Aaron. What a day and what a man! The first thing he wanted to show me was his farm and the few Piper *Cubs* he has there at his grass strip. Following lunch Aaron took us over to the local airport where he keeps all of his other aircraft. Our first meeting ended with Aaron and his family getting in his Cessna 185 and flying off to another appointment, but our interest in aviation guaranteed that it wouldn't be our last.

If you read the article on page 17, you know we are in the process of converting the FAA's Safety Program to the FAA's Safety Team (FAASTeam). As always, Aaron has volunteered to help us promote aviation safety in any way that he can. If you are attending AirVenture® this year, Aaron is on the FAA Forum schedule Tuesday, July 25, at 4 p.m. You also might find Aaron at the FAASTeam exhibit in the FAA Building signing autographs or signing people up on <www.faasafety.gov>.

*Phil Randall is the Assistant National FAASTeam Program Manager.*

# GPS Approach Minima — "How Low Can YOU Go?"

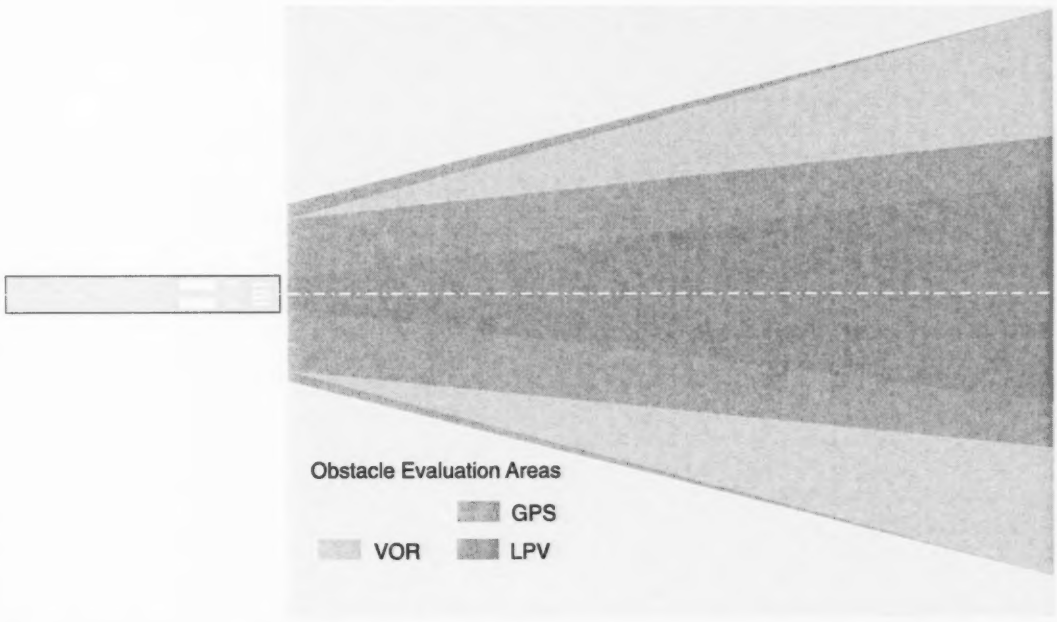
by Martin Heller

The Global Positioning System (GPS) has revolutionized the manner in which we fly. Additional GPS improvements have lowered instrument approach minimums. These improvements increased the types of GPS and Area Navigation (RNAV) instrument procedures and associated minima, which now include: conventional overlays, Lateral Navigation (LNAV), LNAV/Vertical Navigation (VNAV), Localizer Performance with Vertical Guidance (LPV), and circling. Do you know which minima line you can fly? This article clarifies the nomenclature and requirements to fly each of these different instrument approach procedures.

## Background

GPS vastly improves situational awareness for both visual and instrument flight rule (VFR and IFR) flying, reducing circuitous travel and airspace incursions. As importantly, GPS provides an instrument approach capability for airports that in the past have not had either the ground-based navigational aids (NAVAIDs), and/or terrain that supported an instrument procedure. Evolutions in avionics and satellite navigation systems have improved accuracy and alerting capabilities, which result in smaller integrity limits. Smaller integrity limits allow smaller obstacle evaluation areas (OEAs). Smaller OEAs reduce the potential for obstacles. Since obstacles raise approach minima, the smaller the chance of obstacles, the greater the opportunity for lower minimums. (See Figure 1) If you have the proper equipment, you can take advantage of these new procedures. A circling ap-

*(Figure 1. Obstacle Evaluation Areas Differences Based on Navigational Aid)*



proach is actually a procedure based on the aircraft's approach category, not the source of the navigational aid signal. Therefore, circling minima do not change between different types of approaches to the same airport.

## Overlays – 1994

The first authorization for using GPS to fly approach procedures was known as GPS overlays. These procedures authorized use of approved GPS receivers to fly existing non-precision instrument approaches. The only difference was that course guidance could come from the GPS system. These procedures are identified with "or GPS" in the title. (See Figure 2, Moncks Corner/Berkeley NDB or GPS rwy 5). The advantage for these procedures was twofold. First, overlay approaches provide the aviator greater position awareness than that derived from using the ground NAVAID.

Second, although they didn't provide lower minima, GPS overlays also introduced and validated GPS approaches to aviation. This initial validation was critical for future GPS improvements.

**Containment:** Since overlays were GPS approaches designed to overlay the ground-based NAVAID approach, the minimum Required Obstruction Clearance (ROC) and OEA was the same as for the underlying ground-based NAVAID. VOR (Very High Frequency Omni-directional Range) and VOR/DME (Distance Measuring Equipment) approaches have a ROC of 250 feet, while Non-directional Beacons (NDB) have a ROC of 300 feet. The approach chart minima line did not change; "S - (runway number)" identified straight-in approach minima.

**Alerting:** Alerting for GPS approaches became more involved than the ground-based NAVAID system. Ground NAVAID failure results in cockpit warning flags for VORs and Instrument Landing Systems (ILS), Morse code identification removal, and triggering the remote status indicators in the air traffic control facility. GPS avionics alert via an internally calculated integrity alarm. One of the major differences between IFR-certified GPS avionics and other GPS systems is that IFR GPS avionics provide alerting by using Receiver Autonomous Integrity Monitoring (RAIM) algorithms to detect any system faults. Non-IFR certified GPS units do not have this alerting capability.

In order to fly an overlay GPS approach, neither the underlying conventional instrument procedure NAVAID(s) nor the associated aircraft avionics need be installed, operational, or monitored. However, flight planning is slightly different. In addition to checking RAIM availability and GPS NOTAMs, if an alternate airport is required, this airfield must have a non-GPS approach and the ground-based and associated aircraft navigation equipment installed and operational.

**Equipment availability**: Several IFR GPS units are certified according to Technical Standard Order (TSO)-C129, *Airborne Supplemental Navigation Equipment Using the GPS*. IFR GPS units must be either panel mounted or a sensor which provides data to an integrated navigation system, and must be installed in accordance with Advisory Circular (AC) 20-138A, *Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for Use as a VFR and IFR Supplement Navigation System*, or AC 20-130A, Airworthiness *Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors*, as applicable.

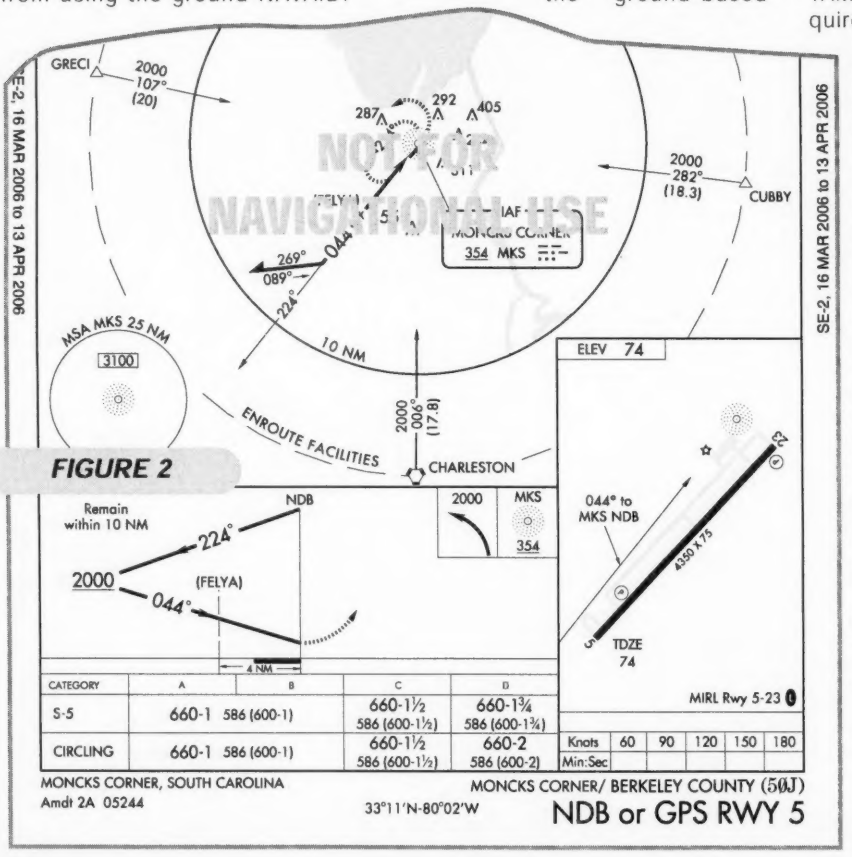
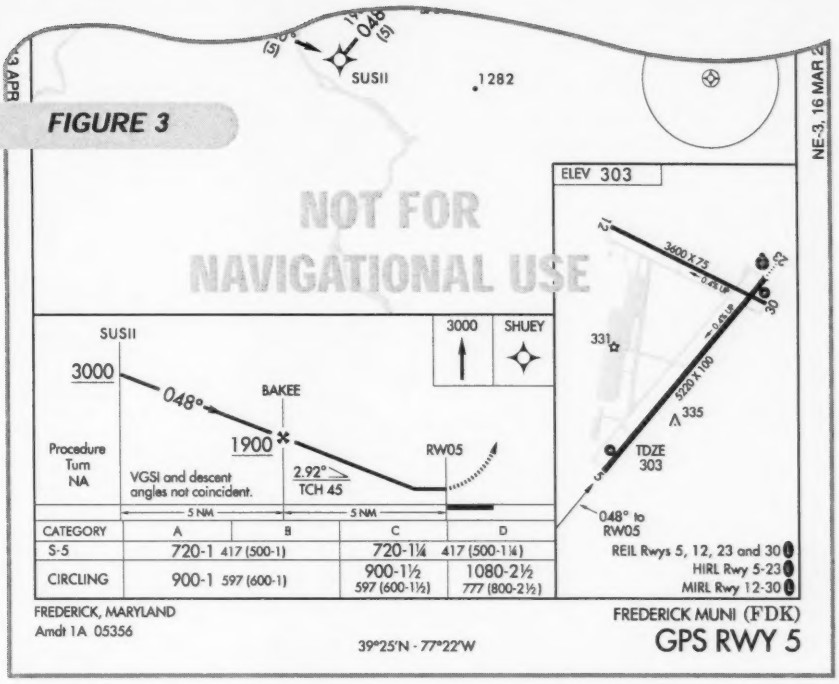



**FIGURE 2**

## GPS Approaches – 1994

The next implementation of GPS procedures were no longer dependant on the NAVAID posi-




tion and coverage. This major improvement provides instrument approaches to airports that didn't have ground-based NAVAID coverage. These approaches were initially published in the GPS RWY XX format (See Figure 3, Frederick Muni, Maryland, GPS RWY 5). However, in 2000 a new approach chart format was adopted by the FAA and GPS approaches began to be published in the RNAV (GPS) RWY XX format (See Figure 4, Frederick Muni, Maryland, RNAV (GPS) Y RWY 23) using the lateral navigation (LNAV) minima line. (Note: All GPS non-precision approaches are considered to be LNAVs, regardless of the publication format.)

**Containment:** Increased precision in position determination and course guidance resulted in a smaller OEA. Additionally, the plan view of the stand-alone GPS procedures uses a "T" design to develop more standardized final and missed approach fix location based on RNAV criteria.

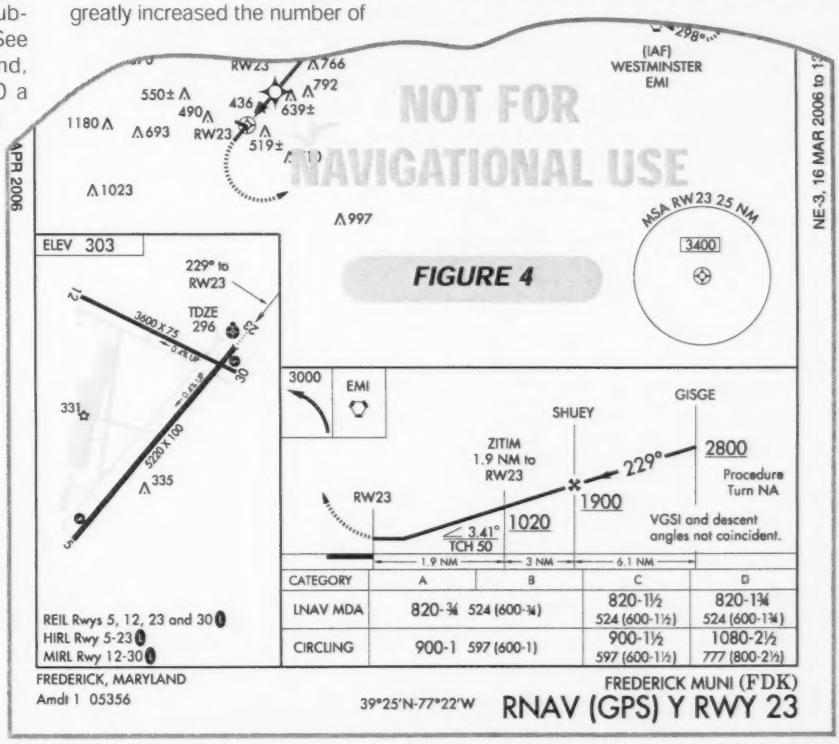
**Alerting:** GPS stand-alone approach availability and signal outages are determined by RAIM.

GPS stand-alone approaches greatly increased the number of locations which could have instrument approaches. As with the overlay approaches, if the IFR flight plan requires an alternate, the pilot must flight plan to use an approved operational instrument approach procedure (other than GPS) that the aircraft is equipped to fly.

Pilots flying GPS approaches can descend to the straight-in (S-runway number) Minimum Descent Altitude (MDA) for their approach category on GPS RWY XX approaches or the LNAV MDA on RNAV (GPS) RWY XX approaches. There are approximately 4,000 GPS (LNAV) approach procedures as of May 2006.

## GPS - Vertical Guidance

The next system improvement added a calculation derived glide path. While not an electronic glideslope, vertical navigation (VNAV) guidance is displayed as a glideslope on the pilot's vertical deviation indicator. This capability came from a combination of Barometric



(Baro) VNAV and GPS equipment. These GPS approaches provide both LNAV based on GPS and VNAV based on barometric sensing. (See Figure 5 Cedar Rapids/The Esatern Iowa (CID) RNAV (GPS) Y Rwy 27. [Note: Wide Area Augmentation System (WAAS) avionics approved for LNAV/VNAV can also fly these procedures without the Baro-VNAV temperature restrictions and local altimeter setting requirements.] VNAV allows for a more stabilized approach, flown like an ILS approach (but to higher minimums).

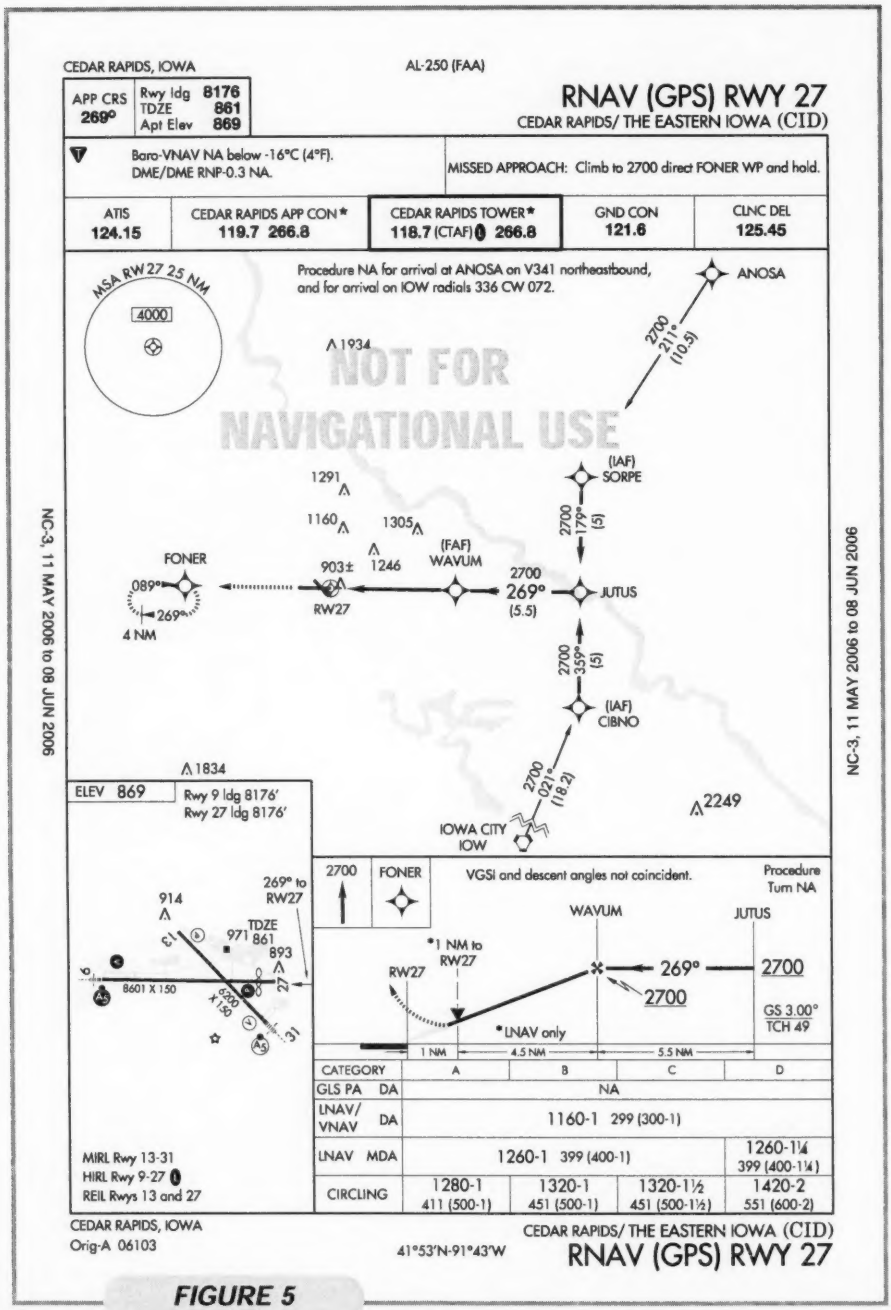
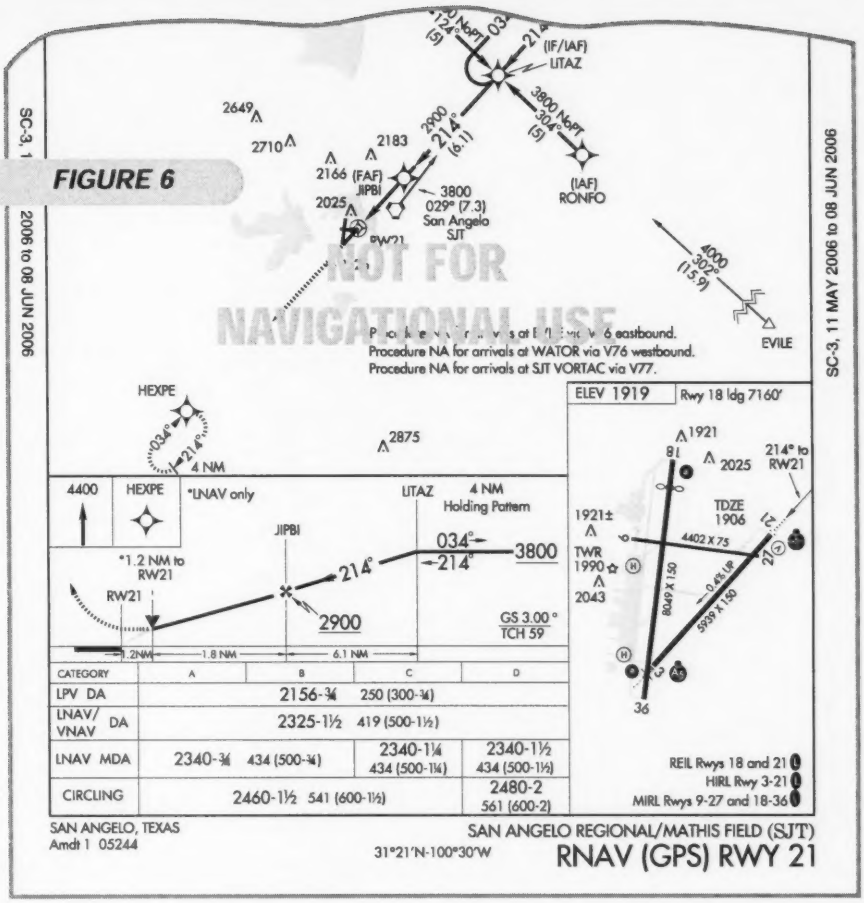



**FIGURE 5**

**Containment:** The ROC on final varies with distance from runway (minimum 250 feet) because the obstacle clearance is evaluated by a sloping obstacle surface rather than a set ROC value. While this occasionally results in minima higher than the LNAV minima, the added safety benefit of a stabilized descent outweighs the difference in minimums. Additionally, a glide path qualification surface (GQS) underlying the glide path from the threshold to the Decision Altitude (DA) point is evaluated to determine if the controlling obstacle's position will allow a vertically guided (LNAV/VNAV) approach to be constructed. The alerting process also uses Receiver Autonomous Integrity Monitoring (RAIM), or the WAAS avionics' integrity function. WAAS uses a complex integrity function based on information transmitted from the ground stations to the Telesat Geostationary Satellite (GEO) to the aircraft avionics.

LNAV/VNAV procedures require an approach certified barometric vertical guidance (Baro-VNAV) system; and a GPS or a WAAS system approved for LNAV/VNAV. This equipment must comply with TSO-C129, *Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)*, or TSO-C145, *Airborne Navigation Sensors Using the GPS Augmented by the Wide Area Augmentation System*, or TSO-C146, Stand-Alone Airborne Navigation Equipment Using the GPS Augmented by the Wide Area Augmentation System. In addition, AC 20-130A, *Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, or equivalent* provides guidance.




More information is available in Advisory Circular 90-97, Use of *Barometric Vertical Navigation (VNAV) for Instrument Approach Operations Using Decision Altitude*.

Pilots flying aircraft equipped to fly LNAV/VNAV approaches may use the LNAV/VNAV or LNAV minima lines. There are almost 900 approaches with LNAV/VNAV minima.

## WAAS - 2003

The Wide Area Augmentation System or WAAS is a major improvement to GPS. A combination of 25 WAAS ground reference stations (WRS) monitor the GPS constellation signals and send corrections through two WAAS Master Stations (WMS) up to two geosynchronous satellites. These satellites then transmit the corrections to a WAAS enabled GPS receiver. (See Figure 6, San Angelo Regional/Mathis Field (SJT) RNAV (GPS) Rwy 21) More WRS are being installed in Alaska (4), Canada (4) and Mexico (5) to improve Northern Hemisphere coverage.

WAAS provides several advantages. First, the geosynchronous satellites provide additional ranging signals into the WAAS enabled receiver, increasing GPS system coverage and availability. Since WAAS monitors and corrects variations in the GPS positioning, the system is much more accurate with smaller alert limits. This smaller integrity limit supports the current generation of GPS approaches, Localizer Performance with Vertical guidance (LPV). Another advantage is that it allows WAAS-equipped users to be able to flight plan and file for alternate airfields with GPS-based approaches. (Note: This includes any procedure with GPS in the title.)

**Containment:** Similar to LNAV/VNAV and ILS approaches, LPV procedures evaluate the Glideslope Qualification Surface. Because of the smaller integrity limit and angular guidance, the size of the obstacle trapezoid is smaller than LNAV/VNAV. In 2003, the minimum height above touchdown (HAT) value was established at 250 feet. In March 2006, it was announced that the WAAS minimum HAT would be lowered to 200 feet if all other airport infrastructure requirements are met. The first procedures to the lower minima should appear in 2007.

**Alerting:** Another major improvement is WAAS alerting. The WAAS horizontal integrity limit is 40 meters on final as opposed to 556 meters for basic GPS. More importantly, WAAS provides vertical integrity, which GPS does not. WAAS eliminates the requirements for RAIM predictions, but crews still must check WAAS NOTAMs. Additionally, on procedures with an inverse W, crews must plan using non-precision approach requirements since vertical NOTAMs are not provided. The inverse W symbols will be removed as the vertical signal availability improves at airports. Future improvements will result from the planned addition of WAAS Reference Stations which will extend and improve WAAS service. Avionics equipment guidance is found in TSO-C145 and TSO-C146.

Pilots can fly the following minima with an appropriately certified WAAS receiver: LPV, LNAV/VNAV, and LNAV. Why would one fly LNAV/VNAV or LNAV minima if they could fly LPV? The reason is that some GPS and RNAV(GPS) approaches have LNAV/VNAV, but not LPV minima. Also, if the WAAS system has an outage, the pilot can still fly the LNAV portion. Think of flying the localizer only approach when the ILS glideslope is out of service. There are approximately 400 LPV approaches al-

ready published and a production goal of 300 more LPV approaches each year.

## LAAS

The Local Area Augmentation System (LAAS) will augment the GPS and complement WAAS by providing an all-weather approach, landing, and surface navigation capability. It is expected that the end-state configuration will pinpoint the aircraft's position to within one meter or less. Curved approach paths, not possible using the current instrument landing systems, will be possible for Category I, II, and III precision approaches as the system evolves. Increased accuracy will allow more arrival and departure procedures. Approaches will be designed to avoid obstacles, restricted airspace, noise sensitive areas, or congested airspace. Similar to WAAS, LAAS works by monitoring the GPS signal, but in the case of LAAS, sends corrections directly to the aircraft. This not only provides greater integrity but also much quicker alerting.

## Other Minima Lines

The GNSS Landing System (GLS) decision altitude was a place holder for ongoing upgrades to WAAS and for LAAS. (Refer to Figure 5). It has been replaced by LPV on the RNAV(GPS) charts. The acronym GLS is now associated with the LAAS minima and will be published on a separate chart when LAAS approaches become available.

## Still Confused?

Perhaps this summary will make it easier. Every IFR-certified and installed GPS unit allows the pilot to descend to LNAV (or Straight-in) and circling approaches. Baro-VNAV -equipped GPS systems can also descend to LNAV/VNAV minima. WAAS receivers can descend to LNAV, LNAV/VNAV, and LPV minima. Need another hint? Look for the DA designation versus the Minimum Descent Altitude (MDA) abbreviation on the minima line. Only procedures with vertical guidance have DAs. (See Figure 7) A descent angle may be provided on procedures which have only LNAV minima, to aid in a stabilized descent, but the MDA must still be respected.

## Need More Information?

You can find a condensed version of the information in this article on page A1 of each *U.S. Terminal Procedures Flight Information Publication* and the *Aeronautical Information Manual* (AIM) paragraph 5-4-5, j. More GPS and WAAS information is available in the AIM paragraphs 1-1-19 and 1-1-20.

See the following Web sites for additional background information on GPS approaches:

- FAA Satellite Navigation: <http://gps.faa.gov/>
- *Aeronautical Information Manual*: <http://www.faa.gov/atpubs/ AIM/AIM.pdf>
- *Instrument Procedures Handbook*; Chapter 5 at <http://www.faa.gov/library/manuals/aviation/instrument_procedures_handbook/>
- FAA National Aeronautical Charting Office (NACO) Introduction to IFR Symbols at <http://www.naco.faa.gov/content/naco/online/pdf_files/7th_IAP_Intro.pdf>
- AOPA's technology Webpage link at: <http://www.aopa.org/asf/safety_topics.html#technology>

The following advisory circulars can be accessed through: <http://faa.gov/regulations_policies/>

- AC 90-94, *Guidelines for using Global Positioning System Equipment for IFR En Route and Terminal Operations and for Nonprecision Instrument Approaches in the U.S. National Airspace System*
- AC 90-97, *Use of Barometric Vertical Navigation (VNAV) for Instrument Approach Operations Using Decision Altitude.*
- AC 90-100, U.S. *Terminal and En Route Area Navigation (RNAV) Operations.*

*Martin Heller is a contractor supporting FAA's Navigation Services, Satellite Program Office (ATO-W). He was a career air traffic control officer in the USAF and is also a Certified Flight Instructor in Single Engine Land aircraft. He is currently building a Vans RV-7 experimental aircraft.*

| Types of GPS equipment req'd | CATEGORY | A | B | C | D | E |
|---|---|---|---|---|---|---|
| WAAS | LPV DA | 296/40 | | 250 | (300 - 3/4) | |
| WAAS, Baro-GPS | LNAV/VNAV DA | 500/50 454 (500 - 1) | | | | |
| WAAS or Baro-RNAV (GPS) or GPS | LNAV MDA | 640/40 594 (600 - 3/4) | | 640/50 594 (600 - 1) | 640/60 594 (600 - 1 1/4) | 640 - 1 1/2 594 (600 - 1 1/2) |
| " " " " | CIRCLING | 640-1 1/2 594 (600 - 1 1/2) | | | 640-2 594 (600-2) | 740/2 1/2 694 (700 - 2 1/2) |

**(Figure 7 - Approach Minimum Equipment Comparison)**

* IFR, Approach Certified Equipment

# Make a Difference In Aviation Safety

## Wanted: Motivated Individuals Desiring to Make a Difference in Aviation

### Aviation Safety Inspectors

Aviation Safety Inspectors (ASIs) are the FAA's on-site detectives. In this role, you will administer, investigate and enforce safety regulations and standards for the production, operation, maintenance and modification of all aircraft flying today. There are many different types of ASIs in four disciplines:

### Avionics*

Evaluate avionics technicians, training programs and repair facilities as well as investigate incidents and inspect aircraft and related equipment.

### Manufacturing

Inspect aircraft, aircraft parts, avionics equipment, manufacturing facilities as well as issue production and original airworthiness certifications.

### Maintenance*

Evaluate aviation mechanics, their facilities and training programs well as inspect aircraft and related equipment for airworthiness.

### Operations*

Evaluate airmen, their training programs, equipment and facilities as well as investigate accidents and violations of major carriers.

### Qualifications

Qualifications vary according to job position. Must have U.S. Citizenship, and for some positions pre-employment drug screening are required.

To find out more about the FAA and our outstanding career opportunities and benefits, visit our Career Web site at

**http://jobs.faa.gov**

For positions with the asterisk(*), you must apply on-line.
For additional information contact:

**Aviation Careers Division**
**Phone: (405) 954-4657**

The FAA does not discriminate on the basis of political affiliation, race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or any other characteristic not bearing on job performance. On an individual case basis, this agency also makes reasonable accommodations for applicants with disabilities.

FEDERAL AVIATION ADMINISTRATION

U.S. Department of Transportation

## • Correction

In the May/June 2006 issue, we inadvertently left off the second paragraph of the Medical Stuff's credit line. It should have read: "This article originally appeared in the *Federal Air Surgeon's Medical Bulletin.*" If anyone is interested in reading this quarterly bulletin, it can be found at: http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/fasmb/>.

## • Comments on the March/April Issue

I liked the articles on the FAA Safety Team, "What to do in a Flight Review," the PLB and the ELT articles, and I found the "FITS is Here" to be interesting. I suppose that's what happens when there aren't enough people to do everything that needs to be done.

As a retired (not by choice) FAA Flight Service Controller, I couldn't help but notice in the article on Sun 'n Fun, that the FAA will have a temporary Flight Service Station at Lakeland. Who will the FAA get to man this station? Will the FAA use Snowe Amendment rehires? Retired FAA controllers? If the latter, who will provide the necessary training and certification? Does Lockheed Martin still have enough employees in Florida to staff a temporary Flight Service without adverse impact to their day-to-day operation? If Lockheed Martin provides the people, is that cost already figured into their contract, or will the FAA have to pay extra?

Back when I had a *Tri-Pacer,* I flew to Sun 'n Fun twice, (Oshkosh all five years) and I always enjoyed Sun 'n Fun, and enjoyed the difference between Oshkosh and Sun 'n Fun. I had a lot of fun with my *Tri-Pacer* flying from my base in Kankakee, IL, to airports in Ohio, Florida, Michigan (Upper and Lower), Indiana, Wisconsin (besides Oshkosh, the Short Wing Piper Club had their annual fly-in at LaCrosse), Nevada (the Reno air races - we didn't place), and ultimately Watson's Lake, Yukon Territories. Although the *Tri-Pacer* was (relatively) inexpensive, it proved to be more than I could afford, so I sold it in '97. I never added up what it cost me, nor should you. Enjoy your *Tri-Pacer* while you can, and try to preserve it for the next owner.

John Stokes.
Via the Internet

*I am glad you enjoyed the magazine. Concerning the Flight Service support at Sun 'n Fun, I don't know the hows or whys of how it is being done. I only know the support is being provided. And as we both know, somehow, FAA is paying the bill. The Government always pays.*

*It is great hearing from a former* Tri-Pacer *owner. It must have been fun flying one to both Sun 'n Fun and Oshkosh. When at either event, I always keep a lookout for both* Pacers *and* Tri-Pacers. *Many of those I have found seem to have someone camping along side the aircraft. People do like their Pipers. I have seen some that were award quality. Then there were those that had seen their better days. But everyone who I have talked with over the years always seem to love their aircraft.*

*Thanks again for writing.*

## • More Info on PLBs and ELTs

I very much enjoyed reading your article about PLBs in the March/April 2006 issue. Whilst I totally agree with your sentiments, I would—if I may—like to comment on one of your points. You state that "there are no non-mounted ELTs approved for aircraft," but in fact these do exist. There are, as you subsequently rightly pointed out, portable ELTs (classified Survival), but what you omitted to mention is that these can also be installed in a bag as well as on a bracket. ELTA have already delivered such units to airlines and manufacturers for installation on existing or new aircraft. Unfortunately, these survival ELTs are still relatively expensive for an operator of a GA type aircraft; a lot of the extra cost being driven by building into the units the capability to correctly function after a crash.

Incidentally, you also describe the activation procedure for the particular PLB which you use. You will note that our survival ELT can be installed in the armed position and if it is then subsequently removed from the bracket or its bag and thrown into water it will automatically be activated by the water. This water activation is not mandatory. The requirement in DO-204 (which also perhaps again explains part of the cost) is that "the equipment shall be designed so that it may be brought into operation using one hand." Our antenna, therefore, deploys automatically when the ELT is removed from its bracket or bag!

Philip Male
Via the Internet

*FAA AVIATION NEWS* welcomes comments. We may edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses may not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Readers are reminded that questions dealing with immediate FAA operational issues should be referred to their local Flight Standards District Office or Air Traffic facility. Send letters to H. Dean Chamberlain, Editor, FAA AVIATION NEWS, AFS-805, 800 Independence Ave., SW, Washington, DC 20591, or FAX them to (202) 267-9463; e-mail address:

Dean.Chamberlain@faa.gov

## DOT SECRETARY MINETA RESIGNS

On July 7, after five and half years as Secretary of Transportation, Norman Y. Mineta resigns to pursue other challenges. Mineta's tenure included the events of September 11, 2001, and its aftermath and creating the Transportation Security Administration, which would eventually evolve in the Department of Homeland Security.

FAA Administrator Marion C. Blakey says of him, "Secretary Mineta is a real icon in the field of aviation. As mayor, congressman, Chairman of the Mineta Commission, and Secretary, his work made terrific contributions to reducing congestion and to the safest period in aviation history. He has certainly left his mark on our skies."

## REVISED DRUG AND ALCOHOL RULE ISSUED

The FAA has revised its drug and alcohol rules. In a final rule issued in the June 21, 2006, *Federal Register*, FAA published changes to its Drug and Alcohol rules that update the following 14 Code of Federal Regulation parts 61, 63, 65, 67, 91, 121, and 135. The changes become effective July 21, 2006. According to the rule's summary, the rule changes the airman medical certification standards to disqualify an airman based on an alcohol test result of 0.04 or greater breath alcohol concentration (BAC) or a refusal to take a drug or alcohol test. Interested readers should review the complete rule for details.

## CERTIFICATION OF AMATEUR-BUILT AIRCRAFT

The FAA's Aircraft Certification Service (AIR) is concerned with amateur-built aircraft that can only be fabricated and assembled with commercial assistance. These aircraft are marketed and sold as eligible for amateur-built aircraft certification. However, they may not meet the requirement of Title 14 of the Code of Federal Regulations (14 CFR) section 21.191(g) that the "major portion" (more than fifty percent) was fabricated and assembled by an individual or group of individuals.

All requests from manufacturers for an evaluation of an aircraft kit requiring commercial assistance to fabricate and build must be coordinated with AIR-200. The Manufacturing Inspection District Office (MIDO) must review the results of their evaluation with AIR-200 before the evaluation can be finalized.

Until further notice, Aviation Safety Inspectors are the only individuals authorized to perform these certifications. FAA designees will not be utilized for certification of these aircraft projects.

Applications for an experimental airworthiness certificate for the purpose of operating amateur-built aircraft requiring commercial assistance to build must be coordinated with Rodney Watson in the Airworthiness Certification Branch, AIR-230, at (202) 267-9540. This must be done before performing a conformity inspection on these aircraft.

The General Aviation and Repair Station Branch, AFS-340, developed *Flight Standards Information Bulletin for Airworthiness* (FSAW) 06-03 to address the safety concerns of AIR-200. Contact Kim A. Barnette, AFS-340, at (202) 493-4922, with any questions or comments regarding this bulletin.

## FAA HIRING AVIATION SAFETY INSPECTORS

The Flight Standards Service will hire more than 200 employees by September 30, 2006. There is a need for operations, maintenance, and avionics aviation safety inspectors with general aviation or air carrier backgrounds. Inspector needs include those with repair station, part 135 operations, and helicopter emergency medical service operations experience. (See the ad on page 41.)

For information on qualifications and the application process, interested individuals can research these positions by going to the following FAA Internet Web site at <www.faa.gov>. Then you need to click on the top of the page tab "Jobs." The Jobs tab will take you to a page where you can find employment information on job requirements and qualifications, application process, forms, and other job-related data.

## PAIRING STUDENTS WITH RETIRED AIRPLANES

Budding high school mechanics may find themselves working on old airplanes instead of junked cars thanks to a new agreement signed by the FAA and the Build A Plane organization. Under the agreement, the FAA and Build A Plane will join forces to help give more aviation-minded students hands-on experience working on real airplanes. Each organization will use its unique resources to send retired aircraft to schools looking to establish an aviation maintenance program.

"Working together, we hope to strongly encourage young people to consider aviation maintenance and manufacturing as a career," said FAA Administrator Marion C. Blakey. "This program has the potential to help build the next generation of world-class American aerospace workers."

Under the agreement, the FAA will share Build A Plane information at teacher workshops, career expositions, and conferences, while both will work closely to develop curricula that promote math, science, engineering, technology, and aviation and aerospace careers. The two organizations also will develop a computer-based aircraft construction and flight testing program for students.

Established in 2003, Build A Plane offers high school students the opportunity to work on real airplanes that have reached the end of their flying days. Taking an aircraft apart, learning how it works and putting it back together helps teach science, technology, engineering, mathematics, and maintenance skills that can lead to aviation career awareness and job paths, Blakey said.

## 2006 NATIONAL GENERAL AVIATION AWARD WINNERS NAMED

In each of the past 43 years, the General Aviation Awards Program and the FAA have recognized a small group of aviation professionals in the fields of flight instruction, aviation maintenance, avionics and safety for their contributions to aviation safety and education.

This awards program is a cooperative effort between the FAA and a dozen industry sponsors. The selection process begins at local Flight Standards District Offices (FSDO) and then moves on to the nine regional FAA offices. Panels of aviation professionals within the various fields then select national winners from the pool of regional awardees. The recipients of this year's national awards are:

• Certificated Flight Instructor (CFI) of the Year: NAFI Master CFI-Aerobatic Richard "Rich" Stowell, a resident of Ventura, California, specializes in spin, emergency maneuver, aerobatic, and tailwheel training. When not conducting training clinics nationwide, he instructs at CP Aviation, Inc., a Part 61 flight school at Santa Paula Airport (SZP).

• Aviation Safety Counselor (ASC) of the Year: NAFI Master CFI Eugene "Gene" Hudson, a resident of Mission Hills, California, is the chief flight instructor and president of Gene Hudson Flight Training, a Part 61 flight school at Van Nuys Airport (VNY). He specializes in instrument, high-performance and technically advanced aircraft training.

• Aviation Maintenance Technician (AMT) of the Year: Joseph "Joe" Hawkins of Murfreesboro, Tennessee, has been an Airframe & Powerplant (A&P) technician for more almost 30 years and has held Inspection Authorization (IA) for 15 of those years.

• Avionics Technician Of The Year: Terry Markovich of Bedminster, New Jersey, has had an interest in electronics since 1967 when he was eight years old. He has been with Duncan Aviation since 1985 and presently works in their FAA Part 145 repair station and avionics department at Teterboro Airport (TEB). There, he manages an avionics shop with 16 employees while supervising avionics installations, installation engineering and troubleshooting in corporate turbine aircraft.

FAA Administrator Marion C. Blakey will present the national awards in July during a "Theater in the Woods" program at EAA AirVenture® 2006 in Oshkosh, Wisconsin.

"These awards highlight the important role played by these individuals in promoting aviation education and flight safety," said JoAnn Hill, General Aviation Awards Committee chairperson. "The awards program sponsors are pleased that these outstanding aviation professionals will receive the recognition they so richly deserve before their peers in Oshkosh."

Information about the General Aviation Awards Program as well as applications for next year's awards can be found at <www.faa.gov/safety/awards/general_av>.

## PRESCOTT AIRPORT GETS NEW TAXIWAY LIGHT SYSTEM

The FAA in an effort to improve runway safety and overall pilot awareness, has installed a new Light Emitting Diode (LED) taxiway light system at Prescott Municipal Airport in Prescott, Arizona.

"Reducing the risk of runway incursions is one of the FAA's top priorities," said FAA Administrator Marion C. Blakey. "This new technology will help improve passenger safety by preventing collisions between aircraft while they are on the ground."

This new system—which is currently a prototype—is a redesigned FAA lighting system that uses LED technology to notify pilots that they are approaching a runway hold line. The taxiway edge lights emit a clear blue light that provides pilots with a visual cue marking the taxiway edge, while the runway guard lights notify pilots that they are approaching a runway hold line. Both are critical visual aids to improve a pilot's ability to identify active runways.

The system has potential benefits for both the airports and passenger safety. It could be installed at large, medium and small airports. In addition to helping pilots be more aware of their surroundings, it provides improved worker safety during system maintenance by significantly reducing circuit voltages. It also reduces operations and maintenance costs, and uses less electricity.

Because the system is more energy-efficient, long-term savings can be significant, even if the initial installation of LEDs is more expensive. FAA engineers estimate that the LED system could reduce energy use by as much as 50 to 80 percent each year. Prescott taxpayers are expected to save between 20 to 80 percent of light system maintenance costs, which currently total approximately $5,700 per year.

The FAA paid the $1 million cost of designing, producing and installing the system at Prescott. Future LED systems will be eligible for financial assistance through the FAA's Airport Improvement Program once they are approved as meeting FAA standards.

# Editor's Runway

from the pen of H. Dean Chamberlain

## You Can Make a Difference

The last magazine I received from one of the aviation groups I belong to, the Popular Rotorcraft Association (PRA), had a chilling article in it. The article outlined what steps the association was considering to reduce costs. One area of consideration was reducing the costs of its magazine. The article said publishing the PRA magazine, *Rotorcraft*, in 2005 cost "about $32 per member." Annual dues are only $45 per member. As you can see, the magazine represents a significant portion of each member's annual dues.

Compared to the large associations with their memberships numbering in the tens of thousands or for the largest which numbers its membership in the hundreds of thousands, this very small association reported it had about 2,000 members. This number is down from the 5,000 members it had in the 1990's.

As a magazine editor myself, I understand the costs involved in publishing. The association is considering reducing the number of issues, which *FAA Aviation News* did several years ago. While we reduced the number of issues, we increased the number of pages in each issue. PRA is considering reducing the number of issues and pages. Another factor faced by any association with a limited membership that publishes a magazine is that advertising dollars may not be significant because of limited sales potential. Advertisers look for either a mass market or a very specialized market segment with a high income/sales potential. This association serves a market that is neither.

That is the problem. This brings me to why I am writing about this issue. I joined the association last year when I started learning to fly gyroplanes because I wanted the latest safety information for flying that type of aircraft. Although the FAA publishes a great reference handbook about helicopters and gyroplanes, *Rotorcraft Flying Handbook*, FAA-H-8083-21, the handbook cannot address current safety issues, new products, safety improvements or problems with a current model.

Although many people like the social aspects of being a member of a group that shares common interests, I think one of the most important benefits specialty aviation associations provide their membership is the collection and distribution of safety information about a specific make, model, or type of aircraft. Although you can research the FAA and the National Transportation Safety Board (NTSB) data bases for accident information and similar type information, I think the best source of information about daily operational issues, problems, and recommended solutions are from those who fly the aircraft on a daily or frequent basis. I think this is why there are so many associations or groups for just about every major category of aircraft, specific manufacturer, or aircraft model/s. A few that come to mind, including one or two that I am a member of, are the Seaplane Pilot's Association, the Soaring Society of America, the Short Wing Piper Club, the Cherokee Pilots Association, the American Bonanza Society, and the Cessna Pilot's Association.

My concern is that the PRA may not have the funding necessary to carry out its important safety mission. According to its Internet home page, PRA, based in "...Mentone, Indiana, at the PRA Mentone Airport, was started in 1962 by Igor Bensen, the inventor of the famous *Bensen Gyrocopter*. Since then it has grown to include rotorcraft of all sorts with members in over 80 countries. We are a group of people who love homebuilt rotorcraft—gyroplanes and helicopters that they build and fly themselves. These rotorcraft enthusiasts get together to exchange ideas, information, help one another, promote safety and help with flight training." The Web site further states in part that the "...*Rotorcraft* magazine, the official PRA publication, is widely considered to be the best source of information about rotorcraft. *Rotorcraft* is the only major magazine devoted exclusively to homebuilt rotorcraft."

Although the PRA is considering expanding its use of the Internet and possibly adding the magazine to its Web site and other cost cutting solutions, I want to use it as an example of the need for all of us who fly aircraft to support those aviation groups that collect and share important aircraft information such as maintenance issues, pilot operational techniques, and time-sensitive safety information for those types of aircraft we fly. I know with today's aircraft fuel prices and all of the costs of just flying, money is always in short supply, but can we ignore the higher cost of losing critical operational and safety information our membership groups provide? I think not. If you fly gyroplanes, gliders, balloons, seaplanes, or some of the other aircraft that are represented by one of the smaller membership groups, I urge you to join your respective group. It needs your participation and support. You can make a difference.

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